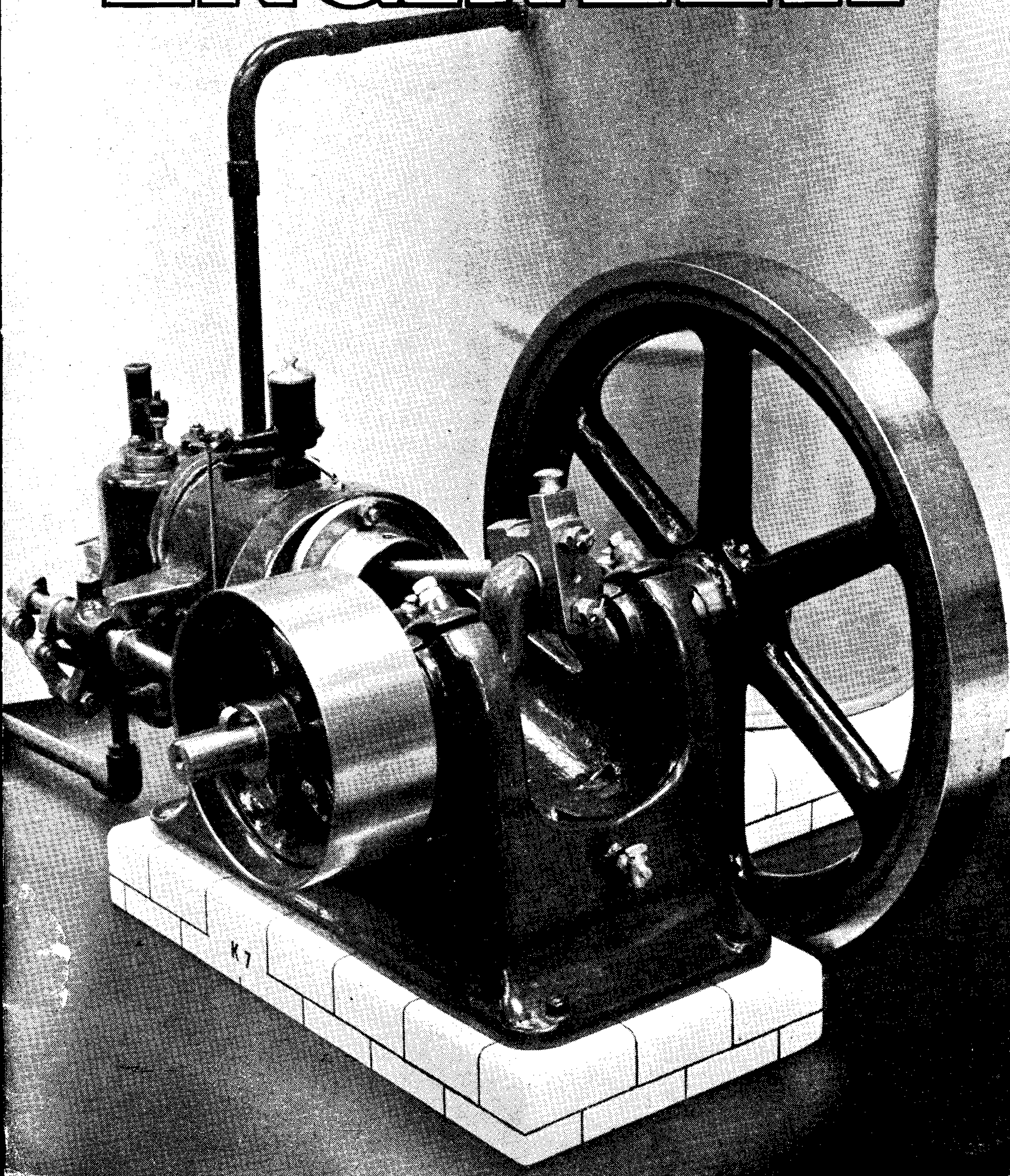
Vol. 105 No. 2632 THURSDAY NOV 1 1951 9d.

THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST.. LONDON, W.C.2

1ST NOVEMBER 1951 VOL. 105 NO. 2632

SMOKE RINGS

Our Cover Picture

● REALLY ACCURATE scale models of internal combustion engines of any kind are extremely rare; constructors of models in this class are more often attracted by the "utility" value of the model than by spectacular qualities of historic interest. One of the very few exceptions to this rule is the model illustrated in this photograph; it appeared at this year's "M.E." Exhibition and received the well-deserved award of Championship Cup in the general mechanical models section. It represents a Tangye gas engine of the 1890-1900 period, and is built to a scale of 3 in. to 1 ft. The constructors, Messrs. A. J. Kent and F. H. Tapper, of Smethwick, are well known for their outstanding work on models of portable and other types of steam engines, which have received awards at previous "M.E." Exhibitions. It may be of interest to mention that there are signs of a revival of interest in the construction of model stationary i.c. engines, which were once very popular among model engineers, but have declined in popularity in recent years, possibly due to the tendencies in modern engine design, which though improving in efficiency, lack the appeal of the older types of engines in which moving parts were visible and speeds not too high to prevent them being seen in motion. The series of articles on "New Engines for Old," which starts in this issue, deals with a smaller and more primitive type of "utility" gas engine, but it will, we hope, help to promote interest in the older types of stationary engines, which played a very important part in industrial development in the late 19th and early 20th centuries.

"Highland Chieftain" Stolen

● MANY READERS will remember the fine $2\frac{1}{2}$-in. gauge L.M.S. "Jubilee" class locomotive, *Highland Chieftain*, built by Mr. W. M. Hunter, of Glasgow; it was the subject of a series of constructional articles in THE MODEL ENGINEER in 1940.

We much regret to learn that this engine was stolen from the window of the Engineering Centre, Sauchiehall Street, Glasgow, on Saturday, October 13th, when it was on display during the recent Scottish Model Engineering Exhibition. Mr. Allan Rodger, hon. secretary of the Glasgow Society of Model Engineers, reporting this loss, writes: "We ask you, please, to publish this information so that other societies can be forewarned that the smash-and-grab raiders include models in the articles they steal.

"This raid was the work of experts, as the plate glass window was neatly cut, leaving a hole of only sufficient size to take the locomotive, leaving the tender . . . A paragraph in your valued paper will help to prevent secretaries of societies going through the torment that I am going through now."

If the publicity which we can give will have the desired effect, and even lead to the recovery of the engine, we shall feel gratified ; but we think it noteworthy that Mr. Rodger, in his distress, can spare a thought for others who might conceivably be placed in the same predicament as he is.

We cannot imagine what motive the thief can have had in his act ; a $2\frac{1}{2}$-in. gauge locomotive of this calibre is not only difficult to dispose of, especially without its tender, but is more than likely to be recognised, and we sincerely hope that we may hear of its safe return to its owner.

The Canting of Railway Curves

● OUR COVER picture for the issue of August 2nd last aroused a great deal of interest among those of our readers who are railway-minded, and if we could have spared the space, there is no doubt that we could have published quite a lengthy correspondence on the subject.

We have just received from the Railway Executive a note upon the adoption of standard limits for the speeds of trains on curves, and in view of the interest shown by so many of our readers, we give some extracts from the note, as follow :

"In view of the differences in practice which existed among the former railway companies in regard to the limiting values for super-elevation or cant of the track, rate of gain of cant, cant gradient, cant deficiency and rate of gain of cant deficiency on curves, the Railway Executive have been carrying out tests, initiated in 1949, to determine the limiting values for these factors consistent with the comfort of passengers. These tests also covered the phenomena of derailment at low speed on curves of considerable cant, and the redistribution of weight on wagon wheels due to twist, which also contributes to the risk of derailment.

"The running lines of British Railways fall into five classes, depending on their importance and on the type, speed and weight of traffic which they carry, and the speed appropriate to each of these classes has to be taken into account in designing curves and in determining the maximum permissible speed, i.e. the speed limit.

"When the speed on a canted curve is such that the resultant of the weight of the vehicle and the centrifugal force is perpendicular to the track, equilibrium prevails, and the speed and the cant are known as 'equilibrium speed' and 'equilibrium cant.' If a train travels on such a curve at a speed greater than equilibrium speed, there will be a deficiency of cant which will increase with the speed ; such a deficiency is permissible within certain limits.

"In selecting the value of equilibrium cant for any curve, regard must be had to the speed limit for the route and to the average speeds of the various types of traffic using the route. It is not desirable, for example, that the value selected should be such as to impose a restriction of speed on the fastest trains, although, on lines where freight traffic predominates, due regard must be paid to the desirability of avoiding excessive weight on the low rail of heavily canted track.

"Railway curves normally consist of one or more circular portions connected to the straight and to each other by transition curves, the radii of which increase and decrease in accordance, generally, with the formula of the cubic parabola, $y = kx^3$. Cant should be run up and run out on the transition curves ; on each circular portion of a curve the cant should be constant and appropriate to the radius of that portion. The increase and decrease should be constant over the whole transition length. Thus the desirable length of a transition curve will depend on the maximum speed and on the cant or the cant deficiency.

"As the result of the tests which have now been concluded, limiting values for the factors mentioned in the opening paragraph have been laid down for general use on British Railways, but wherever circumstances allow the actual values adopted in any case will be well inside those limits. Curves designed in accordance with the new rules will ensure the maximum of safety and riding comfort for passengers."

Calling Wakefield

● MR. DENNIS S. HILL, 46, Elmwood Grove, Horbury, Wakefield, Yorks, has not been very long in the district, but he has already come into contact with some "lone hand" model engineers and is surprised to discover that there is no society catering for them. He thinks that there may be other "lone hands" in and around Wakefield with whom he has not yet come into contact ; at any rate, he and some of his newly-found friends would gladly arrange a "get together" for the purpose of discussing the formation of a model engineering society. Any readers interested in this project are invited to get into touch with Mr. Hill at the address given.

Curwen & Newbery Ltd.

● WE WERE pleased and interested to receive a letter from Mr. David Curwen who has joined up with another old friend of THE MODEL ENGINEER, Mr. A. E. Newbery, and gone into business as Curwen & Newbery Ltd., Engineers, Northgate Street, Devizes, Wilts. The business covers agricultural, general and experimental engineering, machining and toolmaking, but, as Mr. Curwen puts it, whether it will include model work remains to be seen.

Mr. Newbery's interest in traction engines is already known to our readers, but we do not suppose that many will find their way to the workshops of the new firm ; modern agricultural machinery is of rather a different sort !

Mr. Curwen has spent much of the past summer in Wales as Chief Mechanical Engineer of the Tal-y-llyn Railway, and still holds that position. We should imagine that rarely, if ever, before has a C.M.E. overhauled and maintained, practically on his own, the locomotives under his control. But that has been Mr. Curwen's experience, and he writes : "I wouldn't have missed it for anything !" There are only two locomotives on the Tal-y-llyn Railway, but we have no doubt that they kept Mr. Curwen fully occupied. We know, however, that traffic was kept operating on the little railway during the summer.

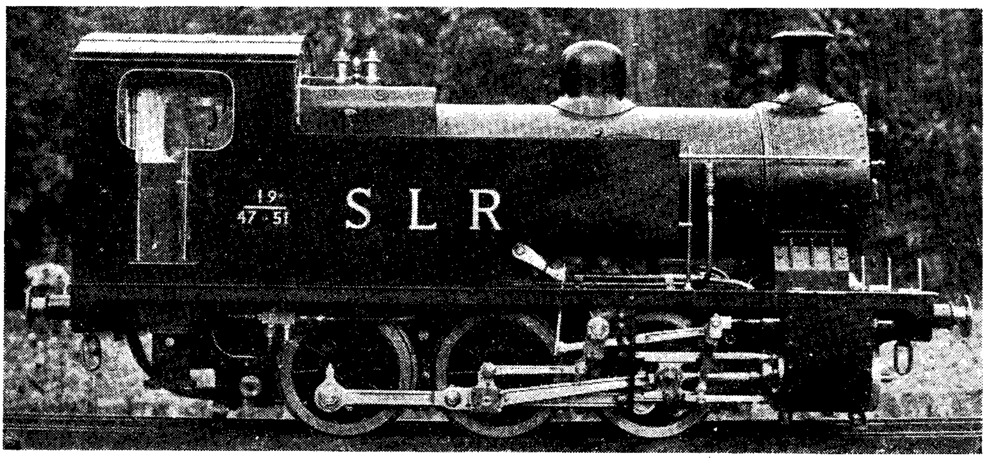
We wish our two friends all good fortune in their new venture and we hope to hear more from them in the future.

"L.B.S.C.'s" Lobby Chat

The Original 2F Takes the Road

REGULAR readers may recall that, some years ago, a design for a 5-in. gauge 0-6-0 tank engine, similar to the small 2F L.M.S. dock shunter, was given in these notes. The design and drawings were by Mr. L. T. Truett, of Sanderstead. The outline drawing was shown, also a section of the boiler. At the time of its conception, there were no suitable castings on the market for such a locomotive, so Mr. Truett got busy on pattern-making; and obtaining the needful castings and material, he set to work. Spare time being very severely limited, it was a long while before he completed the chassis; but when it was ready, he brought it along to show me how it worked under air pressure. He is one of my few personal friends, and lives only a few minutes' run by car, from my home. Well, I'm no flatterer, and when I say it was a truly magnificent job, you can take Curly's word that the statement was gospel truth; and moreover, it worked as well as it looked. It never failed to start, needing no assistance; the turning movement was as perfect as I've seen, and the beats absolutely even. I was able to show a picture of the chassis later, and this may also be recalled. It showed up the fine detail work, especially the lubricating arrangements; our worthy friend intended the locomotive to combine "glass-case" workmanship with ability to do any amount of hard work without ill-effects, or a likelihood of falling to pieces.

Time rolled along, as it has a disconcerting habit of doing, and I heard nothing more of the little 2F for some considerable time; then, early this year, I heard from our friend that the engine was finished, at long last, and did the job according to expectations. Mr. Truett said that as soon as he got the engine painted, he would send me some shots of her, to put in these notes; and I asked him to bring the engine along, as soon as opportunity offered, and try her on my road. I have no 5-in. gauge line on my "non-stop" as the curves would be too sharp for anything in 5-in. gauge except very short wheelbase engines, such as an 0-4-0—incidentally, the 2F would manage it—but I have 108 ft. of straight line, multiple gauge, taking engines up to $7\frac{1}{4}$-in. gauge, which was put in by Mr. R. C. Hammett, so that I could test a 5-in. gauge engine which I put in order for him at the time he built our air-raid shelter.



Mr. L. T. Truett's original L.M.S.-type 2F

The opportunity came to pass on a long evening last June. Mr. Truett brought the engine along, and it was as much as we both could manage to get her out of the car and up to the line. This is a disadvantage of 5-in. gauge locomotives which is entirely overlooked by enthusiastic would-be builders of engines to that gauge. Though now old, I still retain a little of the strength I had when a child, and an average $3\frac{1}{2}$-in. gauge engine is quite as much as I want to tackle! We got up steam, and for the next hour, the engine behaved herself in the manner usually observed by all well-bred locomotives. She steamed and pulled without effort, running no end of a time on one firing; all the blobs and gadgets performed their allotted tasks, and the beats of the exhaust were absolutely even, running as far as it was possible to notch up on a short run. Your humble servant is a pretty critical

person (as if you needed telling that!!), but I found no fault with her.

Our friend renewed his promise of some pictures; and when he came along on a subsequent evening to have a run with my *Jeanie Deans*, he brought the photographs which are reproduced here. You want to see the engine from all angles, to appreciate her properly. The valve-gear is a work of art; neat, yet sturdy. The layout and general construction is clearly shown in the broadside view of the engine. The boiler is made to the general principles advocated in these notes, likewise the fittings and mountings. The firehole door is of the swing pattern, but incorporates an air shutter, so that the amount of air passing over the fire can be regulated according to the kind of coal being used; uninitiated readers may care to learn that smoke from poor quality coal need not black out the landscape, but may be burnt up and used to generate more steam, by judicious regulation of the amount of air passing over the fire. A peculiar type of steam gauge is fitted; you can see it just inside the cab doorway in the three-quarter back view. Instead of the usual circular dial, this one has a vertical scale, similar to that on the bacon scales at the grocer's, the pointer being at the side, and running up and down. Full-size shunting engines of this type usually have a lever reverse, but Mr. Truett fitted a wheel-and-screw, to obtain finer adjustment of cut-off.

The engine is painted plain black, but looks very neat and workmanlike. The letters stand for Sanderstead Light Railway, while the cabalistic inscription at the side, which looks very mysterious, simply denotes that she was commenced in 1947 and finished in 1951. The reason why the cab was finished with a flat back, instead of the regulation 2F bunker, was simply a matter of convenience. The locomotive was not intended to be a slavish copy of the full-sized engine, but a "utility" job, so she was provided with a flat back to the cab, easily removable for driving purposes. In the three-quarter front view, the back is shown in place, one of the big circular windows being visible through the cab doorway. The whole is a truly fine piece of work, for which the designer-and-builder, one and the same party, deserves every credit.

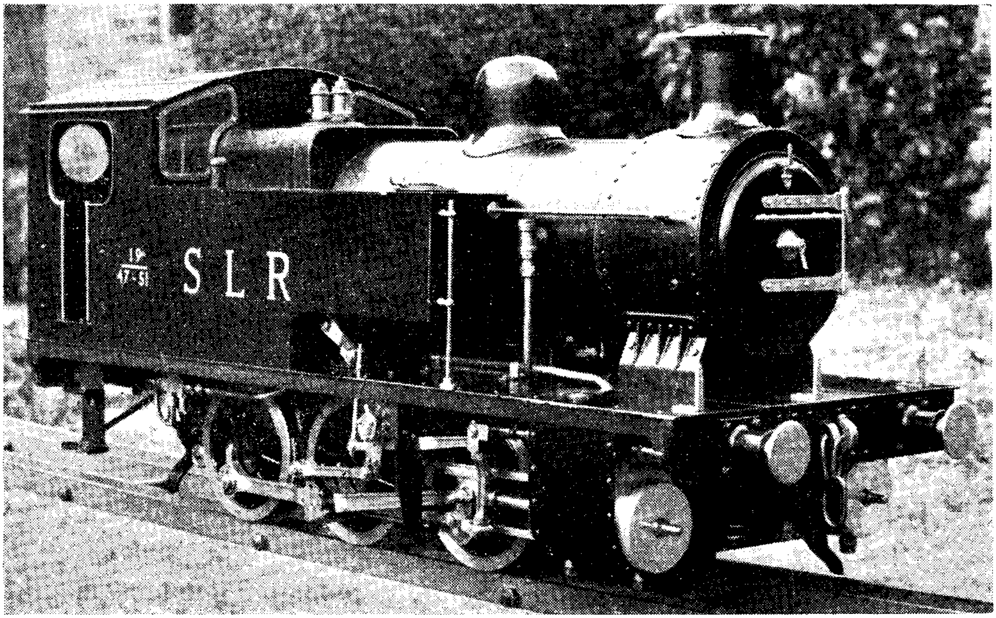
Mr. Truett is now busy on a 5-in. gauge *Britannia*, using my drawings and instructions as a basis, but incorporating much more of the full-size detail than is possible in a 3½-in. gauge job which is expected to work for its living. He didn't have to make any patterns this time, as that Scottish knight of the gouge and chisel, Bro. Wilwau, is doing the needful and supplying the castings. A *Britannia* in 5-in. gauge will be a truly "Bill Massive" outfit; but several other followers of these notes are tackling it, and I have received requests for some notes on the variations to make, also to provide details of a suitable boiler. All sereny, we'll see what can be done about it.

Missing!

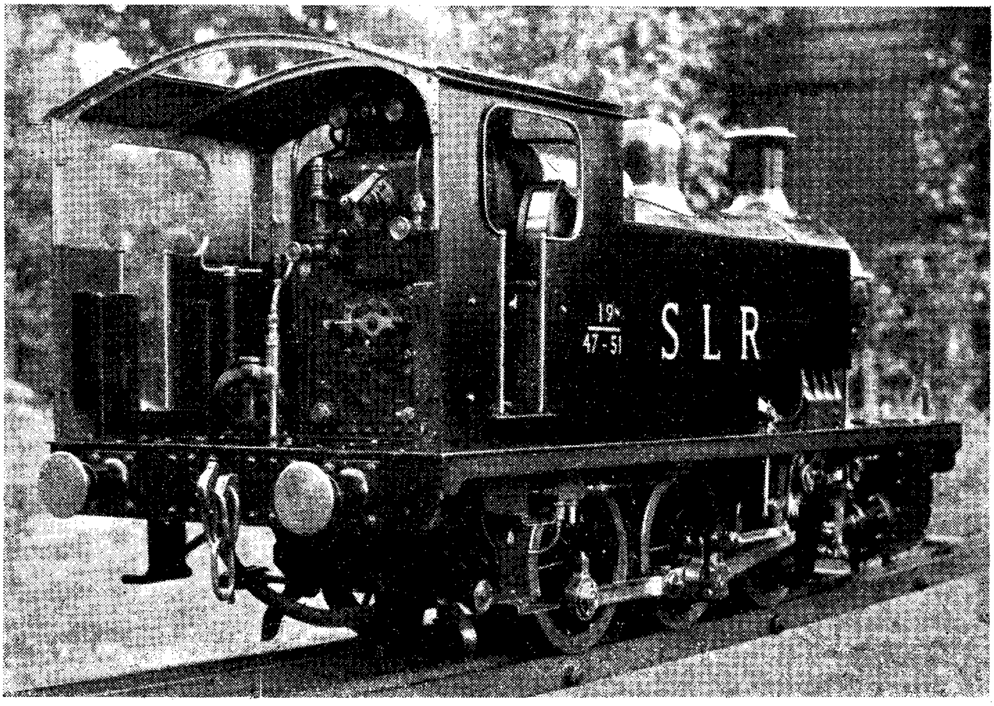
Some of our North Country readers want to know what has happened to the promised serial on a North Eastern 0-8-0, which was asked for in 2½-in. gauge. I haven't forgotten it, by long chalks; indeed, I've settled most of the details. The sole reason why I didn't start it, is the present state of the castings and material position. It is hardly worth while my starting to describe how to build any kind of locomotive, if you can't obtain the wherewithal to do the job. Probably bits of steel plate for the frames, angle for the buffer and drag beams, and iron wheel castings could be conjured up from various sources; but when we come to the bronze and gunmetal castings and material, sheet brass and copper, and other things earmarked for bloodshed-and-destruction purposes, the signals show (appropriately!) red. However, at the time of writing, there is a hope that the "powers that be" may relax in certain ways, and look with a little more favour on a hobby which is not only educational, but affords valuable practice in several different kinds of mechanical craftsmanship. Goodness only knows, with modern "automatic" production methods, craftsmanship should be first priority for encouragement. Most readers have heard of the man who claimed to be a motor fitter; and when asked his experience, he said that he had tightened up nut 57 on every chassis that had passed along the assembly line for fourteen years! 'Nuff sed. Incidentally, I hear from New Zealand that there are no restrictions whatever on the supply of castings and material for locomotive building; the work *is* regarded as educational, and encouraged in every way. Castings for some of my locomotives may possibly be made by one or two firms in that country; so the wind which is blowing so ill in U.K. may blow a bit of good into N.Z.

A "Britannia" Query

A question about the valve-gear on *Britannia* has been put by some eagle-eyed builders who have seen the full-sized engines and become more or less familiar with their details. Although we are still a fair way from the valve-gear stage, I'll clear this point up right away, which will not only satisfy the querists, but obviate the necessity for further correspondence on the same subject. I can now state, without "giving anything away," that the little plot by which I was enabled to present the drawing of a 3½-in. gauge *Britannia* on the day after her big sister made her official public appearance, was hatched up long before the design of the full-sized engines was complete; and some of the official drawings which were sent to me by the C.M.E. of British Railways, and his chief assistant, were the original development drawings, on which final details had not been settled. One of these showed the expansion link supported by bearings of the plummer-block type; an official "artist's impression" of the finished locomotive, one of the finest pencil shadings I have ever seen, also showed this type of bearing. That was how I came to show it thus on my own drawing. However, along with other details, the link trunnion bearings were later altered to the type now used; and when we get to the valve-gear, I shall specify the type of bracket as finally fitted to the full-size Class 7's, and the link trunnions will run in two weeny ball-bearings, so that wear should practically be non-existent, and the valve settings should remain correct indefinitely. Incidentally, the develop-



A locomotive that works as well as it looks!



A neat arrangement of fittings—note steam gauge

ment drawing of the smokebox showed a double chimney, with blastpipes to suit ; but as soon as the tests on the stand at Rugby were over, and the single chimney decided on, I received notification, together with a photograph of a dummy smokebox and chimney, and a half-size line drawing showing the exact shape of the single chimney, with the radius of every curve marked on it, that would have sent our old friend the chimney-line wallah, Mr. F. C. Hambleton, into the seventh heaven of delight.

Unless something unexpected happens, I shall, of course, give a separate drawing of the complete valve-gear layout, both in plan and elevation, same as I have given for the other engines described in these notes ; and the correct bracket, the link trunnion bearings, and the reversing screw at the top of the reverse arm, will all be shown in their proper places. Some good folk seem to be under the impression that these drawings of the complete layout are not necessary, and it is sufficient to show merely the separate components. Don't you believe it ! There would be some hopes of a jigsaw puzzler putting the bits of a puzzle together, if he hadn't the complete picture to use as a guide ; and the same thing applies to a valve-gear—or any piece of mechanism if it comes to that. Separate drawings are made for every single component of a full-sized locomotive, and every one is given an identifying combination of letters and numbers ; for example, the horn-stays of *Britannia's* bogie are drawn separately, and marked SL/DE/19515. How the merry dickens would you know what that bit was, and where it went, without the drawing of the complete bogie frame showing it in position, with the distinguishing marking ?

A Little Thing that Mattered

The following is an amusing example of the sheer cussedness of things in this benighted world. When I had the dream about Billy Stroudley visiting my workshop, and telling me, among other things, that he would fit an " inspirator " on *Grosvenor*, naturally I decided to fit one, and made her a special one, with a cone arrangement that would not only feed fairly warm water, but have no appreciable effect on the steam pressure. In fact, if it is put on when standing, she will make steam against it, as I have demonstrated to personal friends. Well, being curious as to how a certain locomotive would perform on my road, I invited the owner and a friend to come along on a recent Saturday afternoon, and try her, which they did. They expressed a wish to see *Grosvenor* at work, both being Brighton fans, so I took her out to the line. While I had gone back to the workshop to fetch something, the two visitors, thinking to do me a good turn and save time, coupled up the engine and tender, and filled the tank. Now one thing I always like to do myself, is to get my own engines ready ; I don't like anybody else chipping in on the job. Being old-fashioned, I have my own set routine, and if it gets upset, I never feel very happy. However, I said nothing at the time, and did not make the usual tests which are part of my ritual.

The engine was lit up, made steam in the usual time, and I drove her around for $1\frac{1}{4}$ miles, to show the visitors how she did the job. When running, I set the bypass of the crosshead pump to keep just about half-a-glass of water ; but I'm always chary of even personal friends driving my engines, and I usually fill the boilers right up, as a precaution. Other folk invariably use much more steam than I do, and you can't have steam without water ; so I went to put the injector on. To my astonishment and chagrin, the blessed thing refused to feed, and although I tried all full-sized tricks on it, the water just poured from the overflow pipe. I thought the delivery cone was choked with the green deposit which the chemicals in the mains water delight to generate around the boiler fittings. However, the visitors had their drive, and the crosshead pump managed to do the needful ; although with a double load, and an inexperienced driver, plus only one pair of driving wheels, she had a trying time.

I never " let anything go " if I can help it ; so when they had departed, I took off the injector for examination, and what do you think I found ? My diagnosis was entirely wrong. The smaller half of the combining cone was completely choked by a weeny-weeny scrap of rubber, not as big as the head of a dolly-pin. I had to put a drill shank down the nozzle end of the cone, to prod it out. The water could not pass through the cone, so it had simply pushed up the air ball and escaped through the overflow pipe. The reason whereby the obstruction managed to get in, was through the visitors doing the coupling-up. Not being used to it, the one who connected the pipes, had scraped off the fragment of rubber when getting the hose over the pipe on the engine. I always have them tight to prevent any air getting in, which is fatal to injector working. It is one of the reasons why I like to couple up the pipes myself. I found the end of the hose slightly frayed.

I cut a ring off the end of the hose, to present a new smooth surface ; and to make assurance doubly sure, I fitted a sort of brass teat on the end of the injector feed pipe on the engine. The end of this is smaller than the hole in the hose, so the chances of a piece of rubber getting scraped off when coupling up are now very remote. The injector has behaved perfectly ever since, but I'm taking good care that nobody else ever couples up any of my engines again, and only my few friends who are experienced will henceforth take charge of them.

Potted " 'ints and Tipses "

Here are a few " general interest " queries from my recent correspondence, which may help others who are in similar trouble ; I'll call the writers by fancy names for quickness. Alf says that every time he hardens an injector reamer, the taper goes all cock-eyed, and bends backwards. That trouble is soon settled ; put some cold water in a can or jug, and put about $\frac{1}{2}$ in. of sperm oil on top of the water. Heat the taper part of the little reamer evenly, and plunge it *straight down* through the sperm oil into the water. It won't need any tempering ; just rub the flat on your oilstone, and the gadget is all ready for use. I used to work that wheeze at the munition shop, in the latter part of the Kaiser's war, and it always did the trick. Speaking of injector

Continued on page 574)

PETROL ENGINE TOPICS

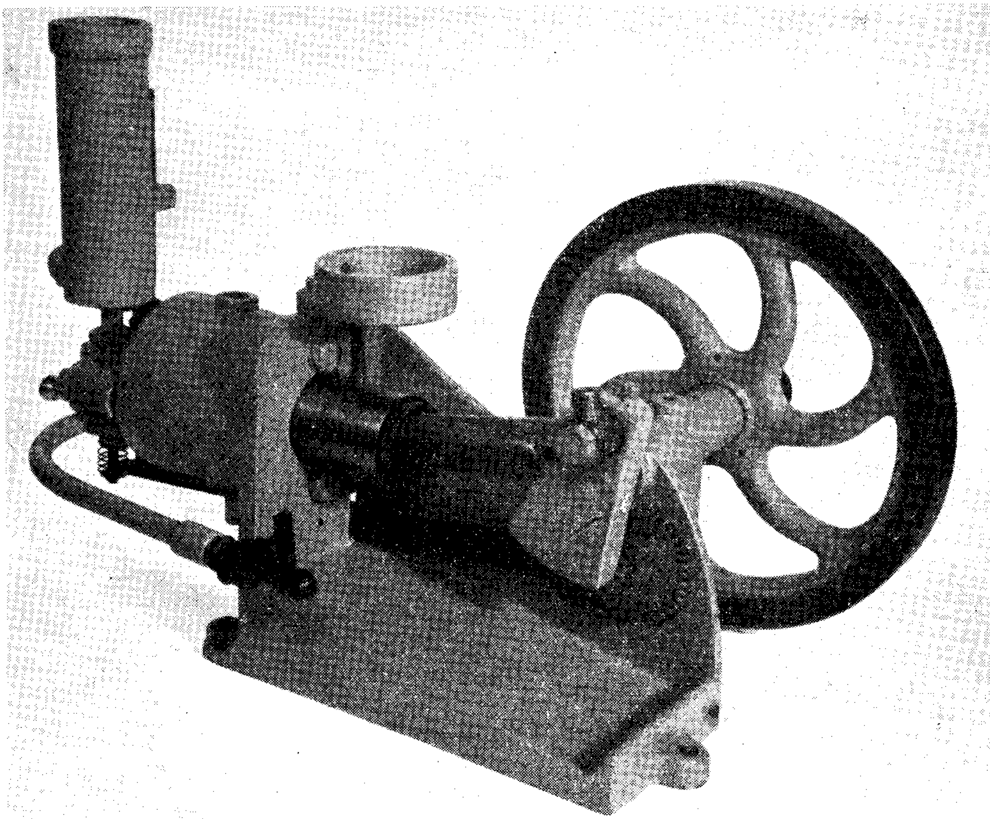
"New Engines for Old!"

How an Ancient Gas Engine was Improved, Modernised, and Given a New Lease of Life

by Edgar T. Westbury

ONE of the first books I ever read in my life (it is so long ago that I have forgotten its name, who wrote it, and even what it was all about) was one of those highly moral stories about poor but honest people, one of whom alone has remained vividly in my memory. This was an illiterate but humorous Cockney character, who described his profession as that of a " translator," and when this statement was somewhat dubiously received, explained that he was employed in a cobbler's shop, " translating old boots into new 'uns ! " It is not necessary to speculate on how complete or effective this process was, but the definition has always seemed to me a very apt one, applicable to many other things besides old boots.

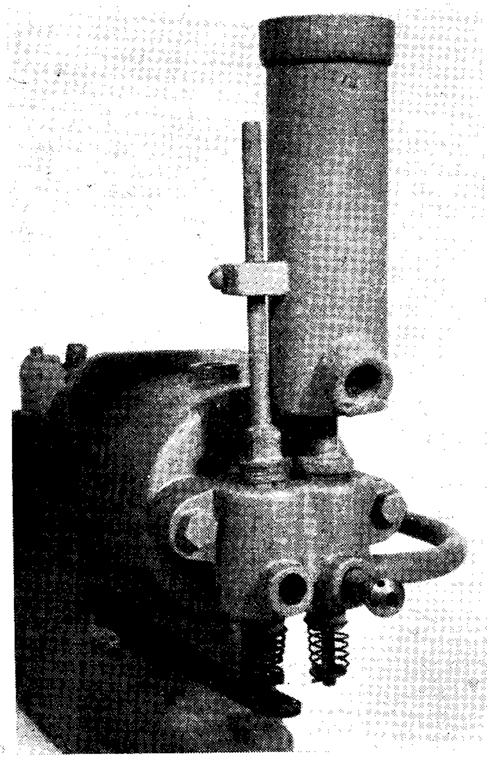
Many of us have at some time, either through choice or necessity, encountered the job of " translating " some piece of machinery—it may be an ancient car, a lawn-mower, or a grandfather clock—in this way, cherishing a pious hope that we may be able to restore its pristine smartness and efficiency, or even making it better than it ever was before—and occasionally



A general view of the engine before reconstruction

succeeding in doing so! The story has often been told in THE MODEL ENGINEER of some old model, discovered in a dilapidated and incomplete state, having been reconstructed with painstaking and loving care, to become a true representation of what it was originally intended to be. Work of this nature can be very interesting, involving as it does not a little research into the origin of the design, in addition to problems of adaptation and detail modification of components.

The question has arisen as to whether, in the restoration of an old model, any attempt should ever be made to improve upon its original design and construction, and it has been suggested that to do so is actually a crime. But surely, this is



A close-up of the valve chamber and ignition arrangements

a case which calls for individual consideration of the merits and purpose of the model. If it is a fairly correct representation of a well-known historic prototype, portraying faithfully the character and tendencies in design of its times, then it would indeed be vandalism to alter it in any way, or even to attempt to make it look too new by any embellishments such as painting and polishing—albeit one should remember that rust and filthiness are not necessarily true earmarks of antiquity. But a model which has never been really true to type, and has obvious imperfections both in design and workmanship, may still be worth restoration, and may justify modification to improve its appearance or working efficiency, or to make it more truly representative of the prototype from which it has been imperfectly copied.

The type of model which is most popular among reconstructors is, quite naturally, the steam engine in any of its many forms, including locomotives, and a classic example in the latter category is the reconstruction of the famous model of the S.E.R. locomotive "No. 1," by the Willoughby Brothers, which was described in THE MODEL ENGINEER in 1930. So far as I am aware, there is no parallel case of the rebuilding of an old internal combustion engine, and this is easily explainable, as hardly any examples of true historic models of this type have ever been made in the first place, and their appeal to model engineers has been from the aspect of utility rather than any aesthetic significance.

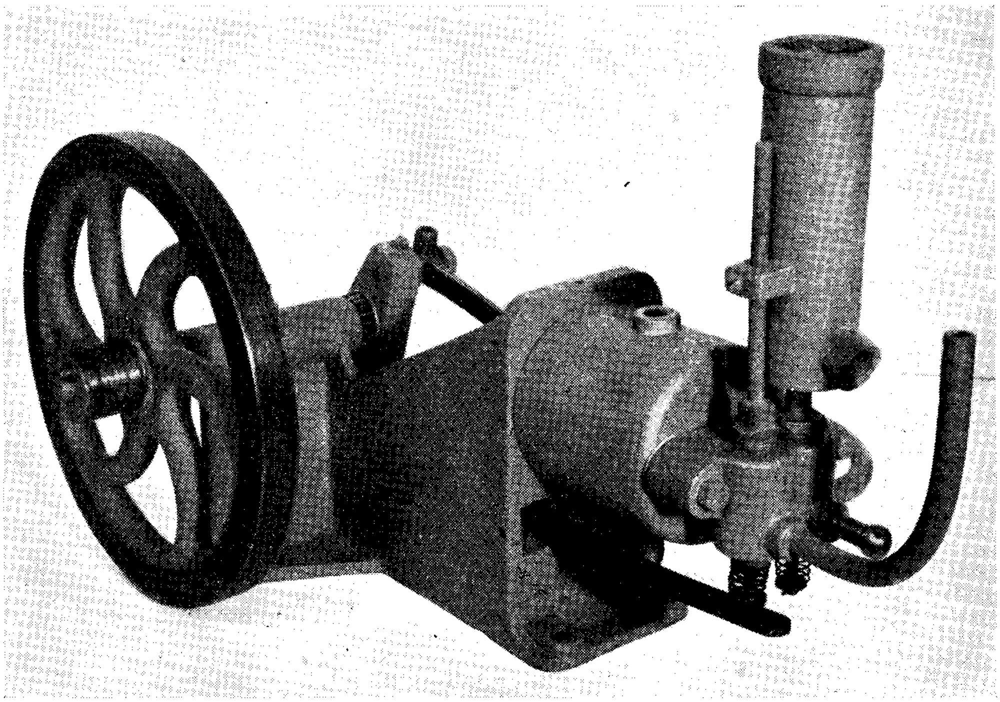
In the early years of this century, the majority of stationary i.c. engines were of the horizontal, open-crank type, and such engines were very widely used for industrial purposes, including power for factories and machine shops. I well remember the two large Crossley gas engines which drove our lineshaft in my novitiate days, and perhaps it is in order to record that we always had ample power on tap, and never a hold-up through "load shedding." Model engineers who aspired to power drive in their workshops often built small engines of similar type, and employed them with great success. I know of quite a few cases where such engines are still running consistently and reliably, requiring very little more attention than the now omnipotent electric motor, and, of course, completely independent of any "centralised" power supply.

Many model supply firms at that time marketed castings for horizontal engines in sizes from $\frac{1}{8}$ to $\frac{1}{2}$ h.p., nominal figures (sometimes optimistic!) based on cylinder size, but justified or exceeded in some cases according to the quality of the design and the work put into it. The names of most of these firms, once household words in model engineering, have now been lost in oblivion some, it must be admitted, without regret—but many of the older readers of THE MODEL ENGINEER will remember the engines of Hardy and Padmore, of Worcester, Scott-Homer, of Cradley, Madison Motors, of Derby, and Tom Senior, of Liversedge. Messrs. Stuart Turner also catered for this class of model with characteristic thoroughness, and still supply castings for one very good horizontal engine, the "Sandhurst," but their older engines, including the classic "600," which was practically a true scale model, have now departed. The reason, of course, is that model engineers are no longer interested in this type of engine; very few of the younger generation have ever seen the horizontal open engine in full-size practice, and are thus to all intents and purposes unaware of any possible alternative to the electric motor as power plant for a workshop. I have always regretted the decline in the popularity in the small "utility" i.c. engine; only those who have had experience with it realise how fascinating it can be, both in construction and in subsequent use.

Some months ago, I was discussing these old

engines at a meeting of our local model engineering club, and a fellow-member, Mr. W. L. Hayward, mentioned that he owned one of them built from a set of castings obtained from the Economic Electric Co. of Twickenham, probably 40 years ago or more, by an unknown constructor. When I expressed interest in the possibilities of improving such an engine on modern lines, he very kindly agreed to hand it over to me for parallel bore and was secured(?) on the shaft by a round key driven endwise, half (more or less) being sunk in each part. It may be recorded that the drilling of this key seating was an interesting study in compound angles, and had it really been tight, the key would have been almost impossible to remove.

A long cast-iron piston was fitted, with two wide ring grooves, but only one ring, and a very



View from cylinder-head end

appropriate treatment, together with an old "Simplex" dynamo which accompanied it—the latter, by the way, has not, up to the present, been induced to work properly, but will be dealt with later if circumstances permit.

The engine is in no sense to be regarded as even an approximate scale reproduction of any full-size prototype, having presumably been designed purely for utility, and with the utmost economy of working parts; indeed its design might be described as rude and primitive, no attempt having been made to study either the finer points of appearance or mechanical working principles.

It had an overhung crankshaft, which in itself is not necessarily a bad feature of design, though not representative of contempory gas engine practice; but this one was by no means elegant, having an ugly wedge-shaped cast-iron web, with a screwed-in crankpin, and a shaft of rather inadequate diameter, running direct in a cast-iron bearing housing, which formed part of the main body casting. The flywheel had a plain slender solid gudgeon-pin. The connecting-rod, of gunmetal, was also of gossamer slenderness. On the vertical rear face of the body, the cylinder was secured by two set-screws; it consisted of a single casting, including the water jacket, and was not bored right through, but had a rectangular slot at the breach end, to which the valve-chamber was bolted. Only the exhaust valve was mechanically operated, the inlet being fitted with a light spring, to work automatically by engine suction. A short air intake tube, with a "rose-jet" entry, but no control device, was fitted to the inlet port, and also a gas feed pipe with an ordinary gas cock. The valve caps were taper-screwed gas plugs, the one over the inlet valve carrying an iron ignition tube, and the other a rod which supported the shroud or chimney for the bunsen burner which was used to heat the tube; this was missing, having probably been "borrowed" at some time in the past to do a soldering job. The shroud was asbestos-lined to conserve heat, and its height was capable of adjustment on the rod.

The timing gear of the engine was very primitive, to say the least. A brass pinion was fixed to the crankshaft, behind the crank web, and meshed with a brass spur gear mounted on a stationary pin screwed into the vertical web of the body. No cam was fitted, its function being served by a steel pin in the face of the spur wheel, which, in the course of its revolution, smote the end of a rocking lever pivoted in an aperture in the back face of the body ; the rear end of the lever was twisted at right-angles so as to have a reasonable chance of hitting the exhaust-valve stem, despite considerable side play on the pivot.

One rather notable point about the construction of this engine was that practically nothing was machined, except where this could not possibly be avoided. The back face of the body was roughly filed to form the cylinder seating, the same treatment being applied to the breach end of the cylinder and the face of the valve-chamber, water or gas tightness being obtained (more or less) by the fitting of thick cardboard washers. Even the crankshaft bearings could hardly be described as machined ; the hole in the casting had apparently been cored, with an enlarged "chamber" in the middle, and had then been opened out with a drill from each end ; the fact that the drill hadn't been pointing quite in the same angle of direction in each case was nobody's business.

Before any attempt was made to alter or improve the engine at all, it was roughly rigged up for a bench test in its original condition. The workshop bunsen burner was used to heat the ignition tube, and after a good deal of struggling the engine was eventually induced to run under its own power—but oh, my goodness, what a clatter ! The mechanical system of the engine was not suited either in its design or construction, to quiet running, and the effect of all the combined bits of backlash in the working parts was rather like that of a shunting engine making contact with a string of trucks—bing—clash—bang ! all along the line, but, of course, somewhat quicker ! However, the object of the test, to ensure that the engine did run in its original condition, and to set up a basis for comparison after the alterations had been made, was achieved. It may be mentioned that the gas consumption in the engine itself was quite small, but about three times as much gas was required to fire the bunsen burner.

A Preliminary Survey

For further purposes of comparison, it was decided to photograph the engine before stripping it down, and it was, therefore, cleaned externally and given a coat of grey paint to render it more "photogenic." The results of these photographs are shown here, and should be compared with those which will be given later of the reconstructed engine. Further photographs were taken of the original components when the engine was dismantled, and are equally instructive.

Having made a careful survey of all the components, plans were discussed for making the best use of all available material in reconstructing the engine. The main castings, including the body, cylinder, valve-chamber, and flywheel were considered sufficiently sound to enable them to be retained. The cylinder bore was in good condition and the piston a good fit, so it was decided that with the addition of new rings and a more robust gudgeon-pin, it would serve its purpose, at least for the time being ; if it became desirable to lap out the cylinder and fit a new piston afterwards, this could be done at any time. Of the other parts, a new crankshaft, connecting-rod, and valve operating gear were considered desirable, also electric ignition, and a carburettor to enable the engine to be run on petrol. These parts were roughly sketched out, to get a clear idea of essentials, but no exact drawings were made until after the job was finished.

Except for a few of the more finicky details such as the carburettor, the actual work of reconstruction was carried out in the "M.E." workshop by my assistant, Mr. J. Message, who has had no previous experience with engines of this type, but has nevertheless turned out a sound job, which has achieved the desired results.

(*To be continued*)

"L.B.S.C.'s" Lobby Chat

(*Continued from page* 570)

reamers, some of our friends make the curve of the stubby one too abrupt It should taper gradually from the point, into a sweeping curve at the base, the curve being like the side of a bell.

Bob says that the valves of his tender pump stick every time he wants to use it. The trouble is that the holes are too large for the ball valves ; the balls go too far down, and the slight deposit, when the water dries out of the pump after use, seals them in. Replacement of the 5/32-in. valve balls by $\frac{3}{16}$-in. will cure the trouble. If any reader finds that the valve balls occasionally stick—I get that trouble now and again, when a locomotive has been standing idle for a week or more—all that is needed to free them, is a crack on the valve box, holding a bit of brass rod against the box and giving it a gentle clout with a light hammer. If the valve box is well away from the filler opening, and awkward to get at, as in Bob's case, simply drill a $\frac{5}{16}$-in. hole in the tender top, over the top of the valve box. Solder a $\frac{1}{4}$ in. × 40 bush in the hole, and make a screw plug to fit. If the balls stick, simply poke a bit of rod down the hole, and give the valve box a jar up, which will instantly free the balls.

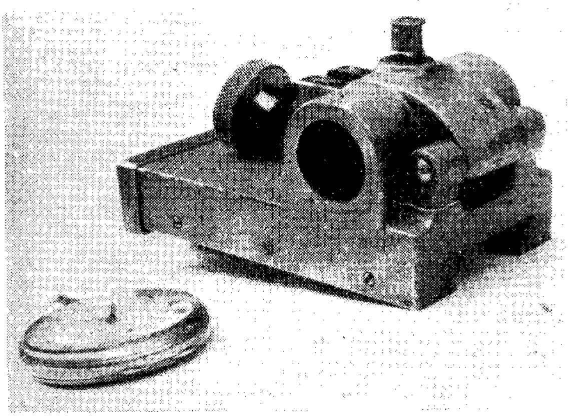
Charlie's injector occasionally jibs, and when he takes the cap off the ball chamber, the ball is invariably sticking in the countersink. That's soon settled ; file a nick right across the countersink. Probably the ball also has too much lift ; try reducing the lift to 1/32 in., which should enable it to seat instantly.

FACTS ABOUT WELDING

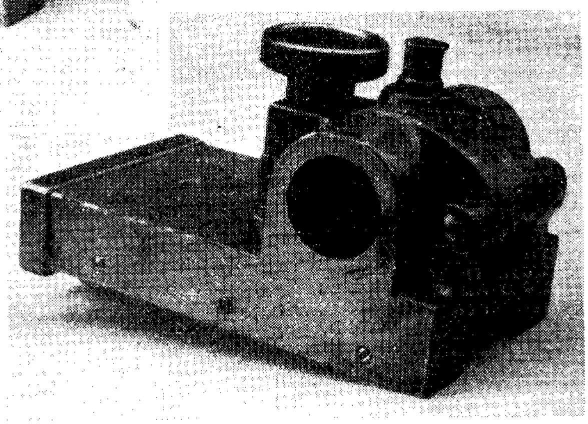
by C. W. Brett, M.Inst.W.

IT is surprising how little consideration is given by some model engineers to the possibilities of welding. This may be due partly to the general impression that this class of work is handled by scientific welding engineers on a scale that lifts it out of model making activities. If readers of THE MODEL ENGINEER feel this way, then they are isolating themselves from resources that can be extremely useful.

The attitude of welding specialists to the needs of model makers is one of helpfulness and, because requirements are likely to be modest, it certainly does not follow that the same expert care and rigid inspection is not applied. In practice, there is only one standard and this is extraordinarily high ; moreover, it is uninfluenced by the size of the job, its cost or other subsidiary factors.



The slide of a single slide-rest of special type belonging to a watch manufacturer's lathe. It is used for pellet-slot cutting. Owing to the crack in the hinge lug, its accuracy was seriously impaired. This was a "precision" repair



The repaired slide. The owners were very pleased with the job, especially as a replacement might have been difficult to obtain, as the lathe and its fittings were of Continental manufacture

Whilst a good deal could be written about the application of welding to models, such as the correction of mistakes, the reunion of broken crankshafts and other parts, it is proposed to deal more particularly with neglected opportunities for using welding methods in the repair or modification of machine tools and all manner of workshop equipment, including small instruments. In regard to the last named, it is not appreciated by many engineers that small components, often of a precision nature, are capable of being handled in this way. A simple example of this is the correction of wear that takes place in the sprockets and other parts of cinematograph projectors.

Needs of this variety seldom involve fracture, the welding being applied to overcome the more common happenings of wear and corrosion. Sometimes extreme hardness is called for, but in these days there is such a wide selection of welding-rods coupled with many variations in technique that almost any specification can be met. Quite often welding is applied in order to achieve results that would hardly be possible in any other way.

Before turning to some pertinent examples of recent work, it may be of interest to mention certain lines of development. For example, the ability to weld together dissimilar metals is one that does not seem to have been exploited by model makers to anything like the extent that the possibilities merit.

A variety of combinations are feasible irrespective of widely differing coefficients of expansion between the metals that are welded to each other. One of the most striking, and at the same time completely successful unions that can be made in this way is that of aluminium to steel. Incidentally, this is a combination widely used in ship building, the type of aluminium alloy employed being of the salt-water resisting variety.

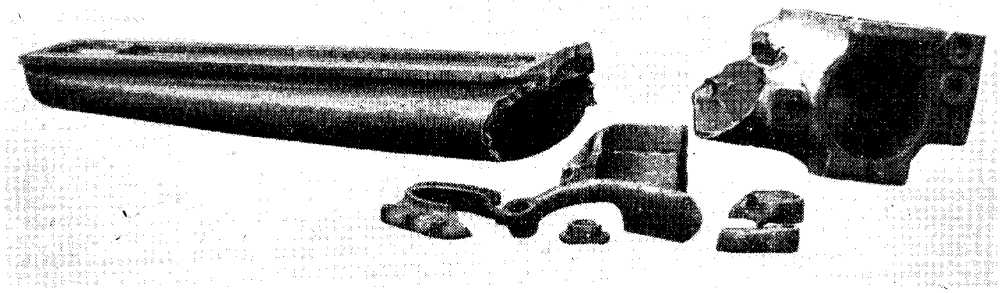
The possibilities of this particular branch of welding technique have proved invaluable as a means for combating corrosion by using stainless-steel, monel metal or other resistant materials.

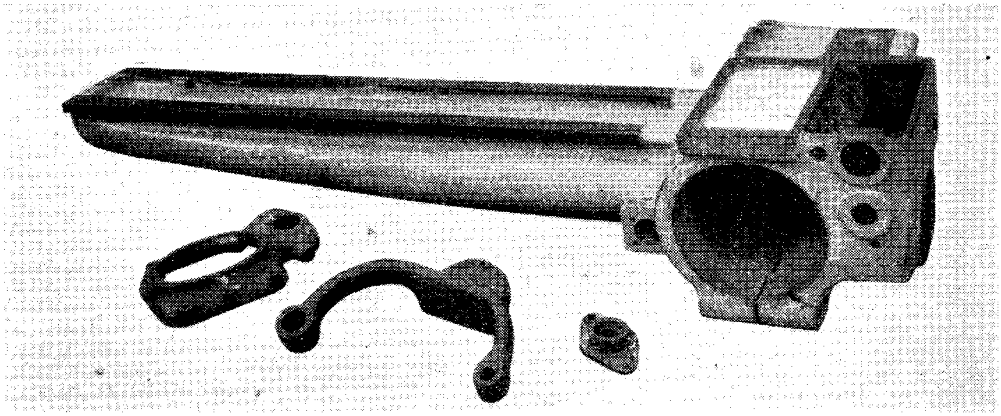
Similarly, when hardness or some other characteristic is required at a particular point, welding may be the only economical and invisible method for achieving the result.

There are other instances of a different nature in which modification to machine tools and other equipment is contemplated. Often this work can be facilitated with particular regard to time saving,

Welding specialists willingly undertake the wide variety of machining that may arise after the preliminary welding has been completed. In this way, when a damaged part is returned, it is restored perfectly to the closest tolerance that may be specified ; moreover, the responsibility for the entire job is undivided.

Turning from the general to the particular,





Above.—Broken arm of a drilling machine. Many bench (and even hand) drilling machines have been repaired by welding

Below.—The drilling-machine arm ready for service again. All the damage has been repaired by scientific welding

by fabricating flame-cut steel plate instead of using castings for which patterns are a necessary preliminary. By using the former method, there is no lack of strength or rigidity, but considerable weight can be saved and, as with all welding, the costs are low.

There are very few model makers to whom expenditure is not a vital consideration. Present day prices are a deterrent to the purchase of coveted machine tools, and indeed workshop equipment of all kinds.

Reconditioning

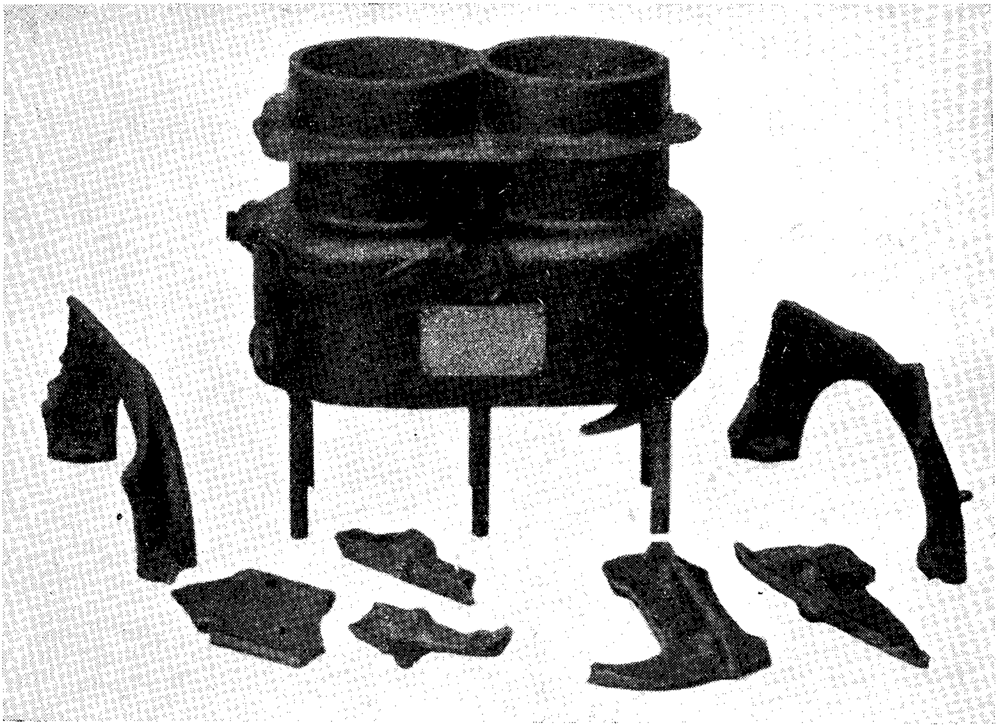
A solution that appeals to many is the reconditioning of second-hand plant, even when it has been damaged extensively and misused, for welding can put matters right under a money-back guarantee even when gear wheels are smashed and new teeth must be built up in the position of the old ones, after which the pinions are perfectly re-cut.

there is far too much tolerance of machine tools, that, through wear or other causes, no longer turn out truly accurate work. In some instances the skill of the operator compensates for the deficiences of the machine, for its weaknesses are understood so well that they are overcome. The writer is familiar with one such machine which, in the hands of anyone but the man who knows its characteristics after years of trial and error, is likely to give results that vary up to 0.01 in.

Unsightly

Few things are more unsightly than a cracked or broken casting that is strapped or has had some other form of mechanical repair made upon it. A job of this kind is seldom dependable indefinitely, which is in striking contrast to the permanency of welding that has been carried out with skill and experience.

A surprising number of machine tools are



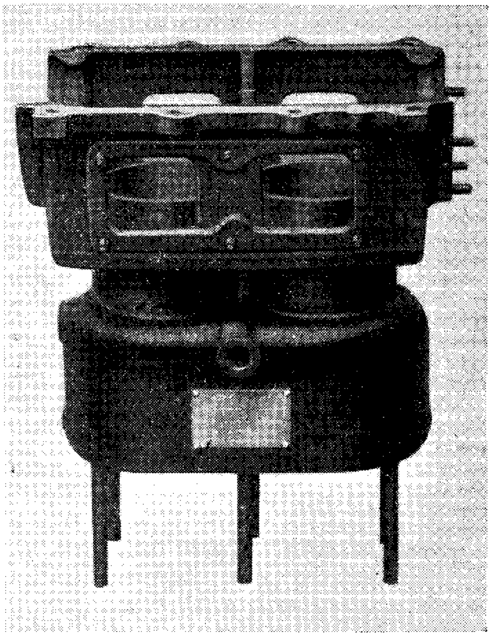
Cylinders belonging to small engines are frequently repaired by scientific welding. This is a miniature water-cooled engine, the crank chamber of which was completely broken away

damaged when being moved from one place to another. Not long ago a brand new radial drill was dropped on to a concrete floor. The gearbox casing was smashed and other damage was done involving two further castings. Welding put matters right in a remarkably short time, the specialist doing whatever refitting was necessary and all under guarantee.

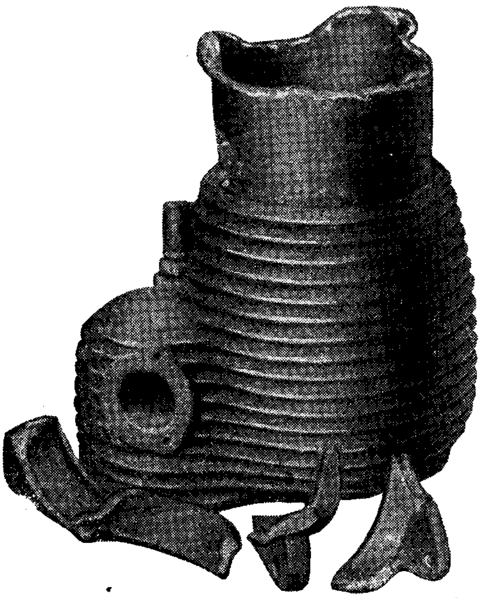
Certainty as to a successful outcome, although primarily due to the skill of the operator, also depends upon punctilious inspection, for no work is passed if it does not attain to the high standards that are set. Final inspection is by radiographical methods. In this way the entire work is made visible in depth and even the quality of the weld metal can be checked with certainty.

Not True Welding

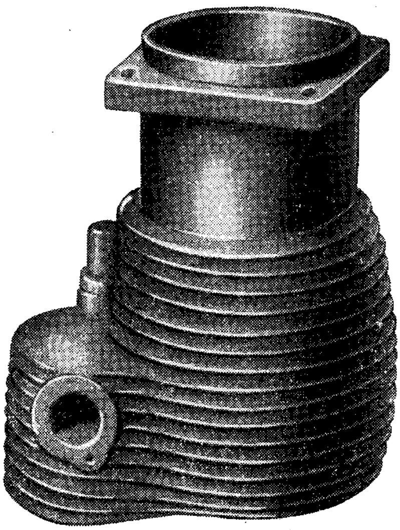
The spraying of metal in molten form is not true welding, but it has many useful possibilities. The selected metal in the form of powder or a wire is passed through an oxy-acetylene flame, the molten particles, which form instantaneously, being ejected from the spray " gun " by compressed air ; these adhere firmly to any matt surface. In the case of metal treated in this way, sand blasting is the usual preliminary, and, if zinc is



At first glance it is not easy to recognise this is the cylinder shown in the photograph above. It conveys a good idea of the intricate nature of some welding work



A small air-cooled cylinder with the base broken off. Fortunately, should an accident like this happen to a model engine, there is no need to make a new cylinder—a repair can be made quite inexpensively



The air-cooled cylinder now perfectly restored by scientific welding

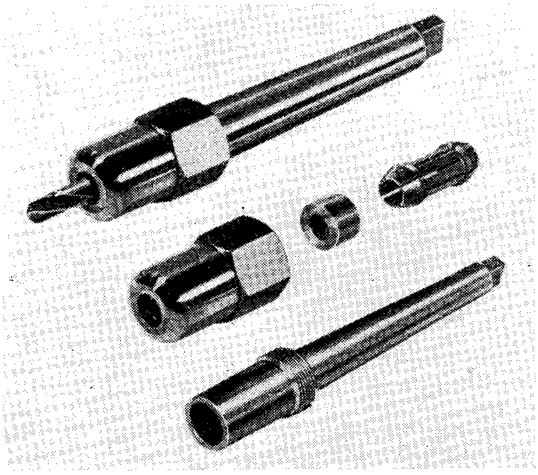
sprayed, the result is equal to the finest galvanising with a coating far more uniform than can be achieved by dipping methods.

It is in regard to repair work, however, that a reminder is timely in relation to the important advances that have been made in welding during the past few years. Also, that scientific welding specialists are enthusiasts and perfectionists, consequently the needs of model makers are met with knowledgeable interest and sound advice, the latter being given without the slightest obligation.

VICTOR TWIST DRILL CHUCKS

The accompanying photograph shows a set of collet type chucks covering a drilling range from $\frac{1}{16}$ in. to 25/64 in., which are specially constructed, and manufactured by Victor Products (Wallsend) Ltd., Wallsend-on-Tyne.

The chucks are designed so that the drill can be gripped on the spiral without fear of damage to the cutting edge. This enables the operator to extend the drill to an exact length for the work, thereby reducing the risk of drill breakage, and providing an accurate depth gauge. Broken drills can be reground and used again with these chucks.

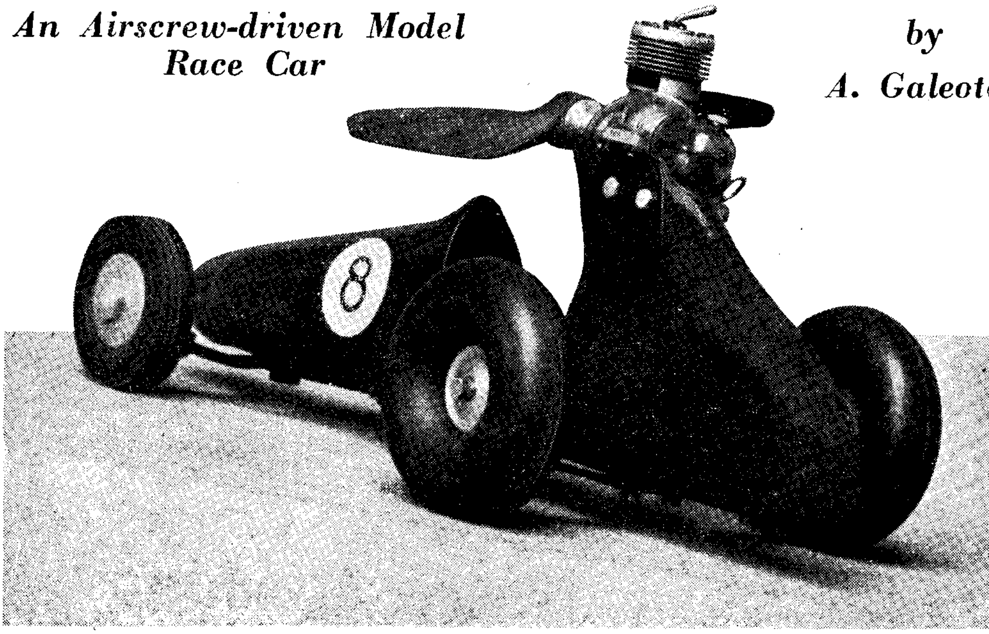


We can think of many jobs in connection with which the possession of such equipment would be found a distinct advantage. Further particulars, price, etc., may be obtained on application to the manufacturers.

"SPEEDSTER"

An Airscrew-driven Model Race Car

by A. Galeota



A model race car powered with a 3.5 c.c. Davies Charlton diesel engine

IN designing and constructing this airscrew-driven model car, I intended to give an idea of how to build a model capable of very high speed at a very low cost, especially to those readers with limited model engineering experience and workshop facilities.

I have constructed two of these " Speedsters " and carried out many experiments with diesel engines ranging from 1.3 c.c. up to 3.5 c.c. capacity, with the latter often exceeding a speed of 55 m.p.h. on a track measuring only 20 ft. in diameter and with a surface consisting of rather rough concrete.

All that is required to build such a model is : an engine, a set of four wheels, two pieces of hard wood, a few pieces of hard balsa, two metal strips for the wheel suspensions, suitable engine mount and a few nuts and bolts.

The construction can be easily understood from the accompanying pictures and sketch, in which the shaded part shows that the " backbone " consists of a base of hard wood measuring about 17 in. long, $1\frac{3}{4}$ in. wide by 1 in. thick, and an upright piece of the same thickness which supports the engine mount.

The whole " backbone " is sandwiched between several layers of balsa sheets or block, shaped to the required outline.

An ordinary type aero spinner takes the place of the radiator and gives to the bodywork a super streamlined appearance.

I have used with great advantage joiners' glue equally suited for hard wood and balsa, and finished the whole job to a very high glossy surface, with grain filler first and nine coats of cellulose paint, rubbing down after the first two or three coats.

Both my " Speedsters " are practically identical except for the engines and wheels. In fact, the one described is fitted with $4\frac{1}{2}$-in. Caton air wheels for the rear, improving the general appearance and proportions of the model.

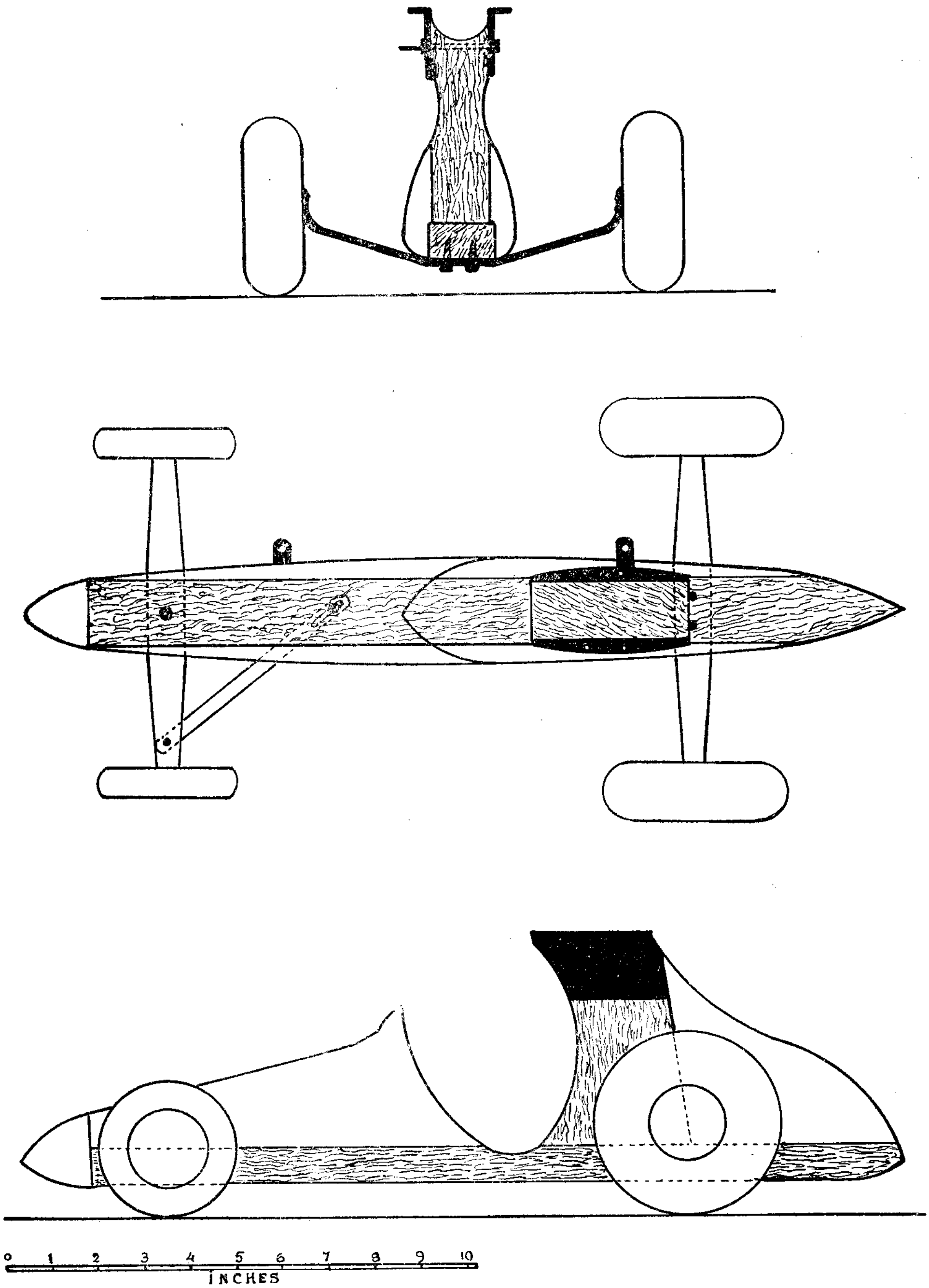
The front wheels are 3 in. with solid tyres, supplied by Messrs. " E.D." The original bushes of the air wheels have been replaced by ones made from old motor-tyre valves in order to take thicker shafts, and both front and rear wheel suspensions are made from brass strips $\frac{1}{8}$ in. thick, $\frac{3}{4}$ in. wide, tapered and shaped as shown on the sketch.

The front wheel suspension is adjustable for steering, and it is fitted to the bodywork with a strong bolt. It can be firmly locked in the desired position by a brace, as illustrated.

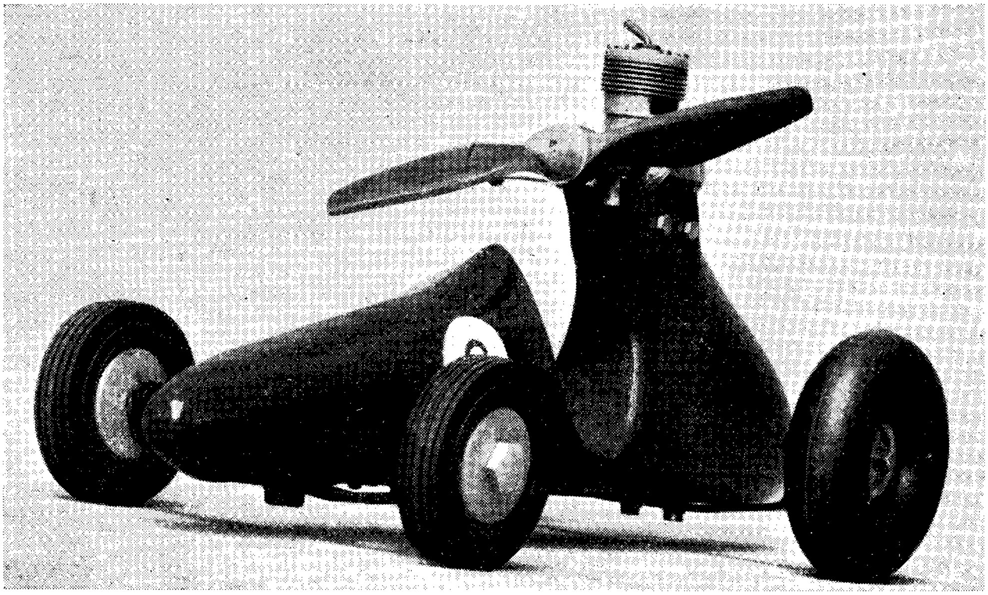
The rear wheel suspension is also firmly fitted to the body by two bolts, and braced.

The engine mount was cut to shape from a thick dural angle-plate and firmly held in position by two bolts across.

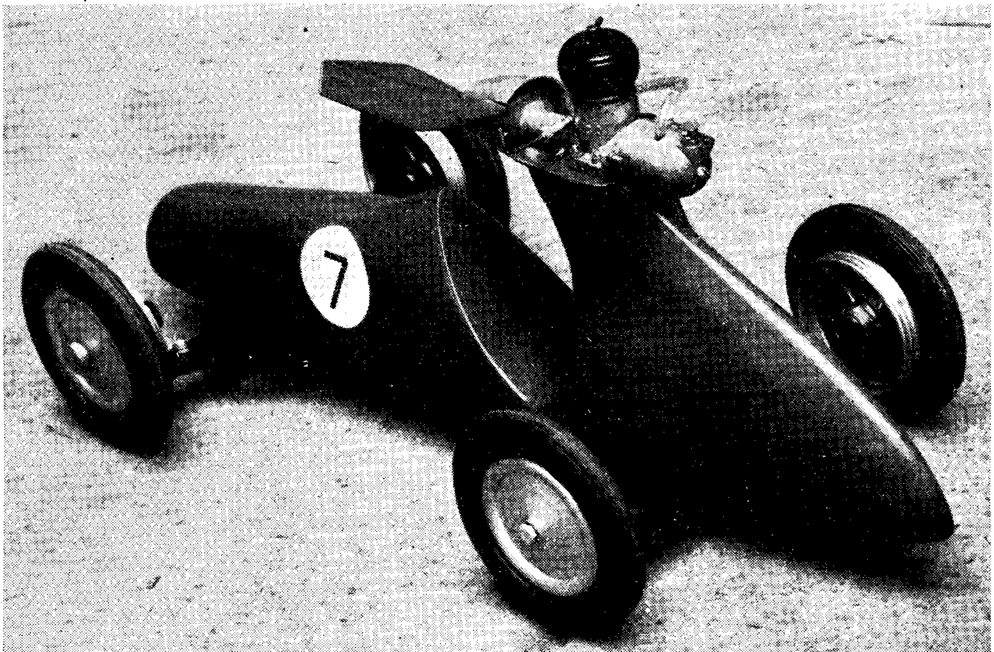
Apart from drilling the few holes, no other precision operation or special tools are required.



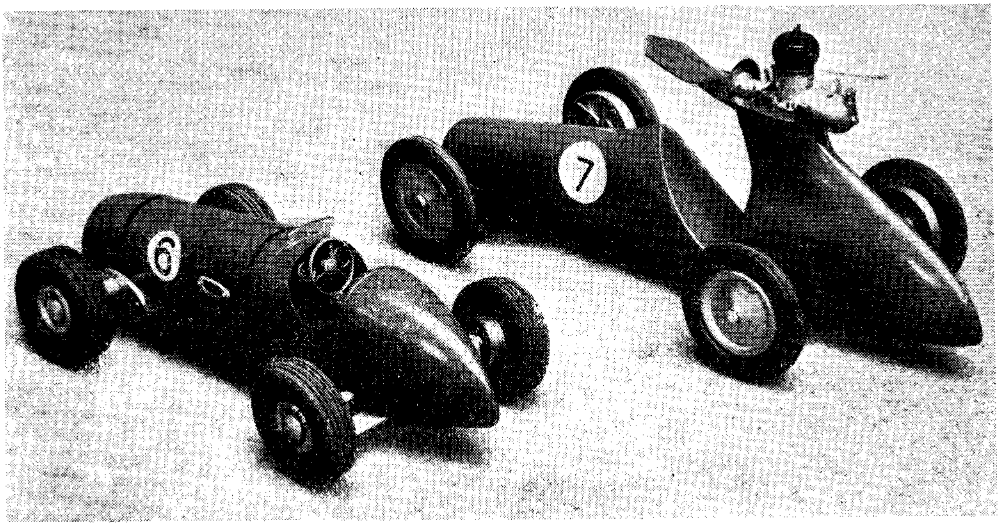
Section, plan and elevation of the airscrew-driven model



Another view of No. 8 race car



This airscrew-driven model race car is powered with an Amco engine of 3.5 c.c. capacity



A gear-driven race car compared with a "Speedster." At speed, both appear practically the same

From various experiments carried out, I have found a 9 in. × 8 in. propeller to be the most suitable, leaving enough clearance between the propeller tips and bottom of the car.

For running, these models are tethered in the same way as those driven by spur gears, except for the rear bridle-lug which is fixed as high as possible below the engine mount to ensure maximum stability.

For the bridle I use the strongest type cable as supplied for control-line model 'planes.

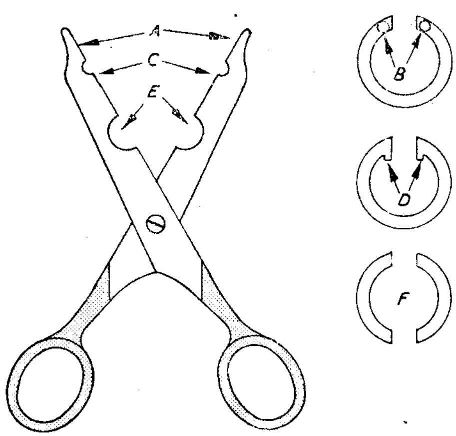
Starting up is carried out with the bridle attached, and as soon as the engine has reached peak revs, the model is released and she will quickly reach her maximum speed. When the engine stops the model will come to rest after many more fast laps.

After hundreds of prolonged runs no sign of wear is yet apparent on the tyres.

My word of advice to the novice: when running this type of model take all due precautions and keep onlookers well protected. A "Speedster" weighing about 3 lb. suddenly breaking from the bridle at full speed is a dangerous missile, and precautions are better than cure.

A HANDY ENGINEER'S TOOL

A DISCARDED or old pair of scissors can quite easily be turned into a very useful tool for the removal of two different styles of wrist-pin locks, and also for replacing split cotters which act as valve-stem spring locks. The two pointed ends of the scissor blades are filed or ground circular (*A*) and a shallow notch (*C*) is cut on the inside of each of these points as shown in the sketch. For the removal of eye-holed wrist-pin locks (*B*) the scissors are simply closed after the points are inserted in the holes, whilst tailed circular locks (*D*) are removed by gripping the two tails in the small notches cut in the scissor points. For the purpose of holding or replacing valve-stem spring locks a semi-circular groove (*E*) is cut in each scissor blade, with approximately the same radius as each of the two halves of the lock. A small quantity of thick grease in each recess will hold the lock-halves (*F*) in place whilst they are being replaced on the valve-stem.—A. J. RICHARDS.



IN THE WORKSHOP

by "Duplex"

No. 101—Making a Twist Drill Grinding Jig

IN response to many requests received from readers, it was decided to design and make a twist drill grinding jig suitable for construction in the home workshop. The jig had to be of straightforward but rigid construction, and provision for taking up wear in the main parts was regarded as essential. To keep the appliance of reasonable size, and to facilitate the machining of the components, the capacity of the jig was limited to accommodating drills up to ½ in. in

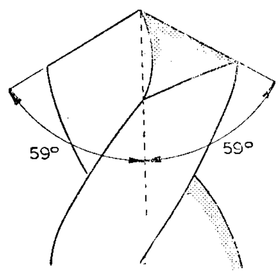


Fig. 1. *Showing the point angle of a standard twist drill*

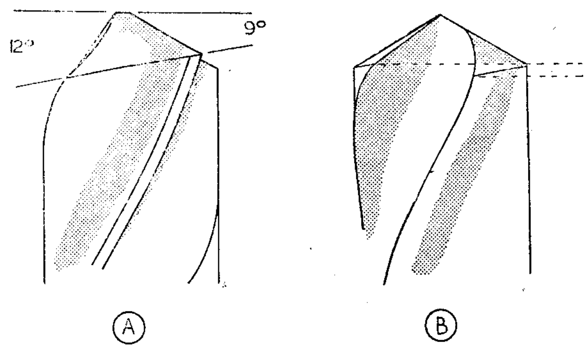


Fig. 3. *Clearance angles or back-off behind the cutting edge*

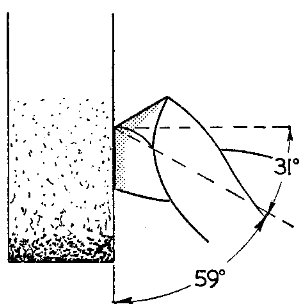


Fig. 2. *Alignment of the drill for grinding the point angle*

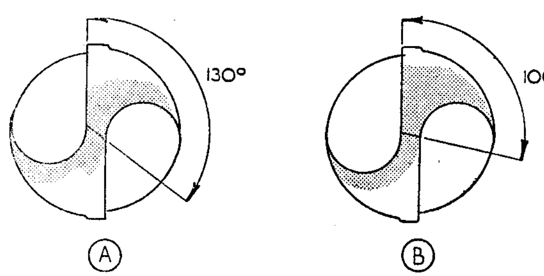


Fig. 4. "*A*"—*the standard arris angle* ; "*B*"—*appearance with reduced back-off*

diameter. As the underlying principles involved in grinding the drill point to the correct form are somewhat complicated, a search for information was made in engineering text-books, and reference libraries were also consulted ; but little information was forthcoming in spite of the fact that these appliances have been in general use for 40 years or more. Fortunately, however, a correspondent in this journal recently drew attention to an article on the subject published in THE MODEL ENGINEER in August, 1913, and written by Mr. L. A. Van Royen. This article gives a detailed mathematical analysis of the constructional requirements, and any pertinent information will now be freely used.

Unfortunately, an appliance of this kind is not readily made up in an experimental form suitable for carrying out practical tests of the correctness of the theoretical data supplied. This meant that the jig had to be constructed in what it was hoped was the final form. However, when the finished jig came to be tried out, using drills of various sizes, it was found that the smaller drills were accurately ground, but, as the size increased, so the form given to the drill point became progressively inaccurate as regards the necessary clearance angles at the cutting lips.

It so happened that another correspondent gave a reference to an article written by Col. H. S. King and published in THE MODEL ENGINEER in October, 1927 ; in this article the writer states that, having made the jig described by Mr. Van Royen, he was able to grind drills of from 3/64 in. to ½ in. in diameter quite accurately.

But the writer also states that for this purpose he used an oilstone wheel of 4 in. dia. mounted on the lathe mandrel.

A wheel of this kind, driven at comparatively low speed, would not be very suitable for grinding the larger drills. Moreover, in a note at the end of the article the Editor stated that the writer

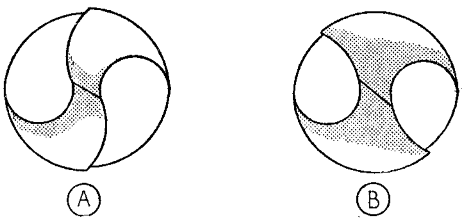


Fig. 5. *"A"—too great a back-off gives a weak, curved cutting edge ; "B"—cutting edges become hooked when the point angle is too great*

had submitted a number of small drills ground on the appliance, and that these were perfectly accurate. It seems reasonable to conclude, therefore, that this writer was mainly concerned with small drills and, perhaps, found that the larger drills were well enough ground to suit his particular purpose.

Nevertheless, it would be interesting to know if other workers have made up drill jigs to the specification given in 1913 and, if so, what results have been obtained, for the jig made in our own workshop was constructed exactly in accordance with the published data, and a critical examination failed to reveal any discrepancy. It was, however, found possible to alter the jig, to grind all sizes of drills accurately, without having to scrap any of the parts already made. Reference will be

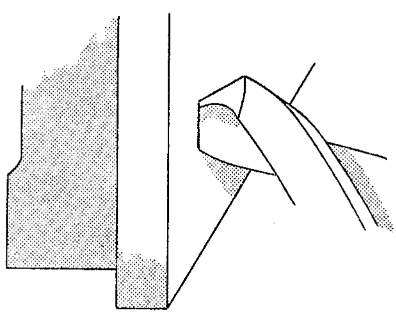


Fig. 6. *Demonstrating grinding movement with drill held against the surface plate*

made to this departure from the published specification at an appropriate place in the text that follows.

Before describing the actual construction of the grinding jig, it will be as well to consider the form of the drill point, and also the theoretical requirements in the jig to ensure that the drill is applied to the grinding wheel so as to reproduce this form with exactitude in drills of varying diameter.

As shown in Fig. 1, the point of a standard, general-purpose drill is ground to an included angle of 118 deg. ; this is readily provided for in the jig by setting the pivot of the drill carrier at an angle of 31 deg. to the face of the grinding wheel, as represented in Fig. 2. Next, as is usual in cutting tools, adequate clearance must be given behind the cutting edge to enable the drill to bite into the work and cut a substantial chip ; for if the point of the drill were ground in the form of a plain cone, like the tip of a lathe centre, cutting would, of course, not be possible. When this clearance is correctly ground, the clearance angle increases as it falls away behind the cutting edge, and the diagrams in Fig. 3 show the form this clearance takes.

The degree of clearance can usually be estimated by examinining the arris formed on the axial web of the drill. If, as shown in Fig. 4B, the tip of the drill is ground to a true cone and no clearance angle is formed, the arris will then lie approximately at right-angles to either cutting edge, but as the clearance angle, or back-off, increases, so the line of the arris comes to lie at a greater angle to the cutting edge. For ordinary

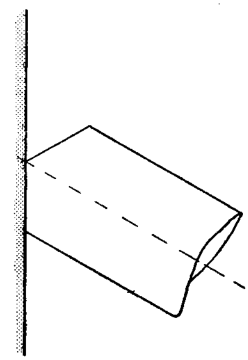


Fig. 7. *Rotating the drill on its axis forms a conical point*

work, this angle, as represented in Fig. 4A, has been standardised by the drill manufacturers at 130 deg. Inspection of the drill point, or comparison with a standard drill, will at once show if the clearance angle has been correctly ground and, as a check, this angle can readily be measured with a protractor.

When the full amount of back-off is given, the drill will cut chips of the full thickness required in rapid commercial drilling, but for amateur use slightly less back-off may be found an advantage, for the drill will then be less liable to chatter when counterboring, or to grab on breaking through the work.

For ordinary drilling work, therefore, the drill will be found to cut well if the angle made by the arris with the cutting edge is reduced from the standard 130 deg. to between 120 deg. and 125 deg., but this is largely a matter for individual experiment.

Two common grinding faults are illustrated in Fig. 5 : in *A* the back-off given is too great and, in consequence, the cutting edges have become thinned and weak as well as being crescent-shaped ; in *B* the included angle at the drill

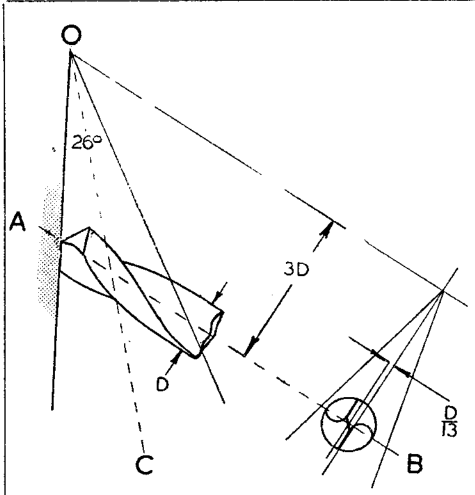


Fig. 8. Showing the cone angle of 26 deg.: projection of the drill beyond the pivot axis: and the side-shift required

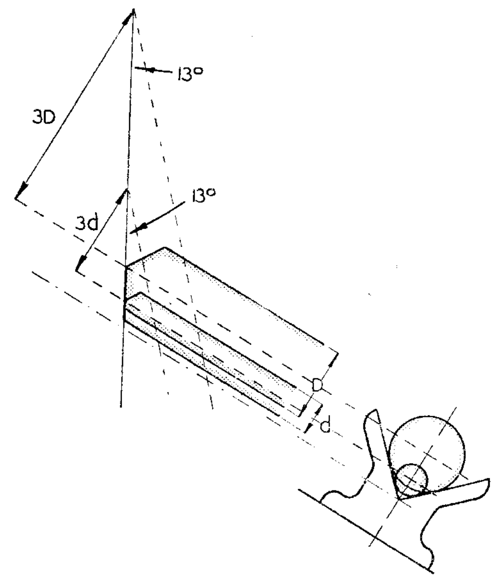


Fig. 9. Showing the cone angle provided by the jig, and the positions of a large and small drill

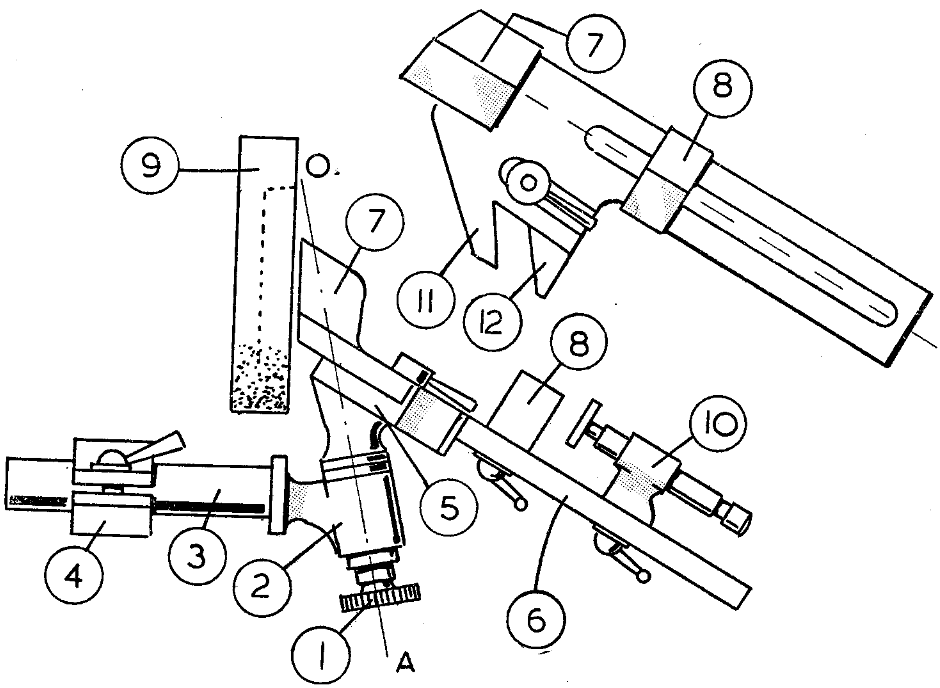


Fig. 10. The early type of drill jig described (Van Royen)

point has been made greater than 118 deg. and the cutting edges then tend to become hooked.

As will be seen later, the grinding jig can be adjusted, within limits, to vary the back-off angle at will.

Although the shape of the individual lip has been considered, it is essential that both cutting lips should be identical in form, otherwise the drill will not cut a hole of the nominal diameter, nor will it tend to follow a straight path in the work.

From the description given of the rather complicated shape of the drill point, it will be clear that free-hand grinding is most unlikely to result in grinding the drill correctly; nevertheless, some workers with long practice become surprisingly adept.

Those wishing to test their skill, or to demonstrate to themselves the complex movement required, have only to set the surface plate on edge, as illustrated in Fig. 6, and, after the plate has been smeared with marking paste, to apply the drill as though to the grinding wheel. The motions of grinding the drill are then gone through and the accuracy of handling will then be indicated by the extent of the marking transferred to the drill.

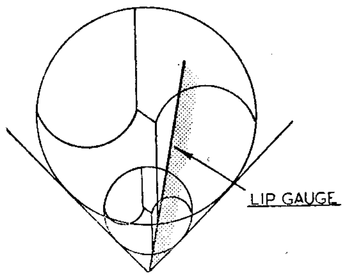


Fig. 11. Lip gauge for maintaining the drill's cutting edge upright

This is not quite the whole story, for, in practice, any dwell during the grinding operation will tend to form a flat on the drill face, and even if one lip has been correctly ground, it still remains to make the other an exact copy. However, an operator with very little skill can grind a drill on a well-made jig with very great accuracy. When the drills ground in the present jig were tested, it was found that not only were the chips from the two cutting edges of apparently equal thickness, but both chips formed coils of approximately equal diameter and pitch; in addition, the drill itself fitted closely in the drill hole formed.

Principles of Construction

At this stage, reference will be made to Van Royen's article for the geometrical construction of the jig necessary to form the back-off at the drill point.

If, as represented in Fig. 7, the drill is merely revolved on its axis while in contact with the grinding wheel, the point will take the form of a cone having an axis common to the drill axis.

In Fig. 8, AB is the drill axis and OC is the axis on which the drill is made to turn, and it follows that the nearer the point A is to the apex of the cone at O, the steeper will be the curvature of the back-off imparted to the drill point.

Van Royen states that good results are obtained when the value of the cone angle at O is made 26 deg. and at the same time the distance from the apex of this angle to the drill axis is made equal to three times the diameter of the drill. As shown in Fig. 9, reproduced in a modified form from the Van Royen article, this distance is varied in accordance with the drill's diameter by bringing the drill point in advance of the pivoting axis for a distance equal to 1.4 times the drill's diameter.

In this way, the back-off suitable for a drill of any particular size can be obtained by adjusting the setting of the jig.

In addition, this writer states that the drill axis must be displaced to the right of the cone axis for a distance equal to 1/13 of the diameter of the drill. However, this amount of displacement was found not to work out in practice, and reference will be made to a corrected figure when the actual construction of the jig is described.

The drawing of the grinding jig described by Van Royen has been reproduced in Fig. 10 in almost its original form, and the same principles of construction are still embodied in modern appliances.

The main pivot (1) of the jig rotates on the axis OA in the bracket (2) attached to the sliding shaft (3) that is clamped in the base bracket (4). The table (5), secured to the upper end of the pivot, carries the sliding drill carriage (6).

The drill being ground rests in two V-blocks (7) and (8) and can be fed forward against the grinding wheel (9) by means of the tailstock (10). To set the drill, the main pivot is moved away from the wheel by sliding the shaft (3) in the bracket (4), and the correct position of the drill carriage in relation to the pivot axis is then set by closing the caliper jaws (11) and (12) on the shank of the drill used as a setting gauge. After the jig itself has been slid forward to bring the front V-block close to the wheel, the drill is placed in position resting against the lip gauge, illustrated in Fig. 11, and the appliance is then automatically set for grinding the drill correctly.

This, then, is briefly the way the jig works, and there is no need, at this stage, to go further into the constructional details, for these should become clear when the actual making of the jig is described in subsequent articles. As the description unfolds, it will be seen how the construction provides for all the movements and settings necessary to give the drill point the correct form and back-off.

Although the underlying principles have been dealt with at some length, this will, no doubt, appeal to those interested in the theoretical as well as the practical side of the subject; but for a full geometrical analysis, readers should consult the original article referred to. However, these details can be disregarded where the sole object is to make up the appliance; nevertheless, if the results obtained in working prove unsatisfactory, a grasp of the geometry involved will be found the surest guide to putting matters right.

(To be continued)

TEST REPORTS

Some expert comments upon items submitted by the trade

The Eclipse Surface Gauge

THE fine quality of these tools had been noted when visiting engineering exhibitions and it was, therefore, very satisfactory to receive two examples for test from the manufacturers, Messrs. James Neill & Co. of Sheffield.

The two surface gauges submitted were the No. 100B with a base of $1\frac{5}{8}$ in. $\times$ $2\frac{3}{16}$ in. and having two spindles 4 in. and 7 in. in length, and the No. 101 with a base $2\frac{1}{2}$ in. $\times$ $3\frac{1}{8}$ in. and a 9 in. spindle.

Except for minor details, the two gauges are of similar construction, and the high finish throughout gives the tools a very pleasing appearance.

The base is of hardened steel ground to a fine finish on the lower contact surface and at one end. A deep V-groove is machined on the under surface of the base to afford a seating on round work.

Two retractable register pins are fitted for aligning the tool on the lathe bed or against other guide surfaces. The sides of the base are hollowed so as to afford a convenient grip for the fingers. The mottled finish of the case-hardened base has a very fine appearance and could hardly be bettered.

By adopting a spring-controlled rocking lever for the fine adjustment of the spindle setting, the assembly is made very rigid and, at the same time, the control is very smooth and free-acting. The rocking lever itself is a die casting and, although some, no doubt, would hesitate to approve this mode of construction, it should, nevertheless, be borne in mind that in this way much expense is saved, and can be spent to better advantage elsewhere in the tool. Moreover, unlike many die castings, this component is machined on the two bearing surfaces for the lever pivot and the spindle clamp, and the surfaces of the casting are also finish-ground. As shown in the exploded drawing, a conical-headed pivot-screw is fitted, and in the larger tool this is secured with a grub-screw. The joint was found to work smoothly and without shake; in addition, this form of pivoting is adjustable to take up wear. The position of the rocking lever, when making a fine adjustment of the scriber height, is set by means of a knurled finger-screw fitted to the far end of the lever. As this screw, of course, moves the lever in one direction only, a strong compression spring, bearing on the lower end of the lever, is housed in the base to give the reverse motion. This spring also serves to eliminate any backlash in the joint formed by the lever pivot.

The body of the spindle clamp is formed with a conical nose to engage in the taper seating machined in the rocking lever, and a light turning pressure on the knurled finger-nut was found to give a secure grip. At its other end, the clamp and sliding sleeve lock the spindle securely in position.

Three thousandths of an inch clearance is allowed in the cross-drilled hole carrying the spindle, but in the writer's workshop surface gauge, less than one thousandth of an inch is sufficient for free-sliding movement as well as for firm locking with only light clamping pressure. The head of the spindle clamp is also cross-drilled to take the scriber, so that for small work the main spindle can be dispensed with.

The spindle, of $\frac{5}{16}$ in. diameter in the larger tool and 7/32 in. diameter in the smaller, is accurately ground to a fine finish,

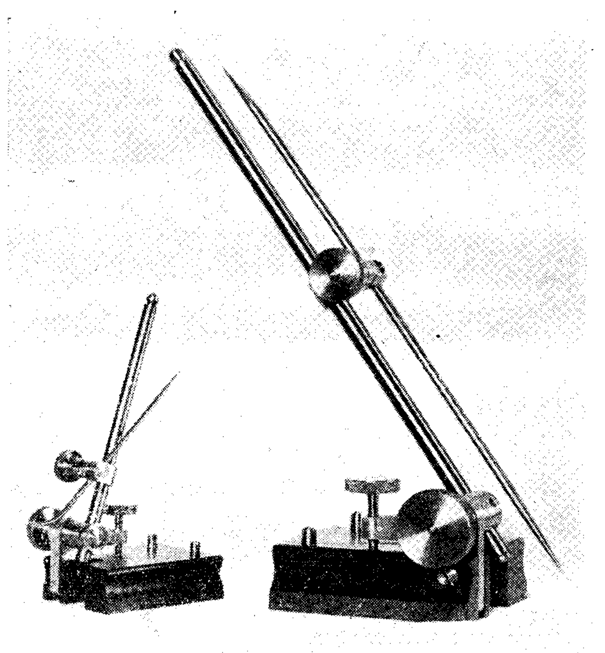


Fig. 1. Two sizes of the Eclipse surface gauge

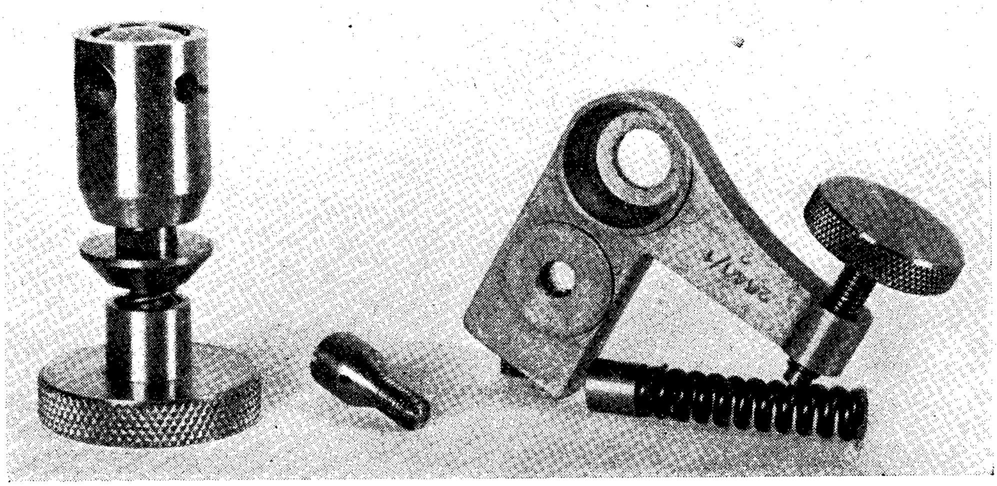


Fig. 2. The rocking lever and spindle clamp parts

and at the lower end a circlip is fitted to prevent accidental withdrawal of the spindle.

The split scriber clamp, fitted with a cross-drilled collar, is of the usual pattern and in the larger tool the head of the clamp is also cross-drilled with a ¼ in. diameter hole for mounting the attachment spindle of a standard dial test indicator. The scribers are well finished, but if some of the points were more fully hardened, resharpening might be less often required.

This is a well-made and highly-finished tool of straightforward design. Both fine and coarse adjustments of the spindle are readily made, and the working parts can be relied on to remain rigid under all ordinary conditions of use in the workshop.

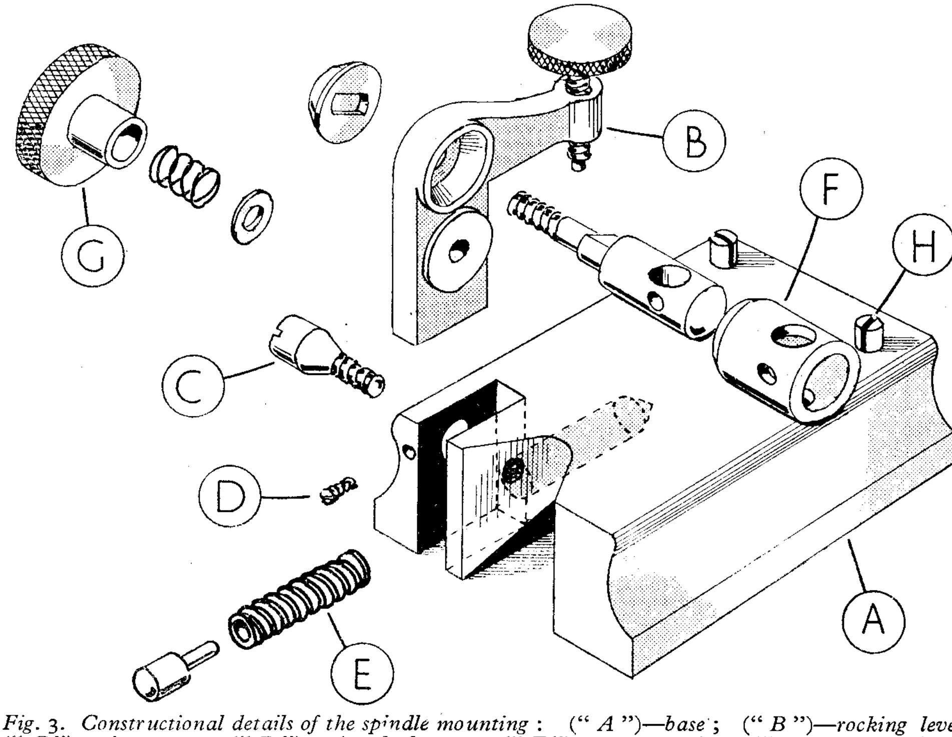
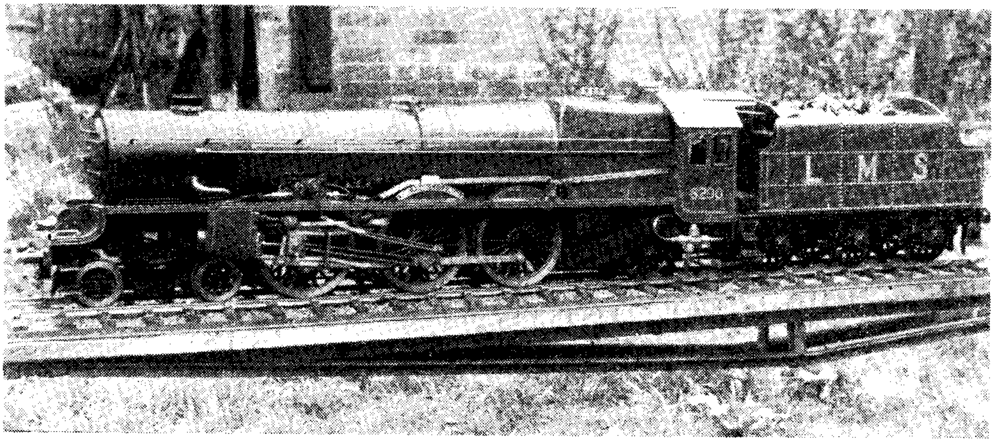


Fig. 3. Constructional details of the spindle mounting: ("A")—base; ("B")—rocking lever; ("C")—pivot screw; ("D")—pivot lock-screw; ("E")—return spring; ("F")—pillar clamp; ("G")—pillar clamp-nut; ("H")—register pins



The model ¾ in.-scale " Princess Royal "

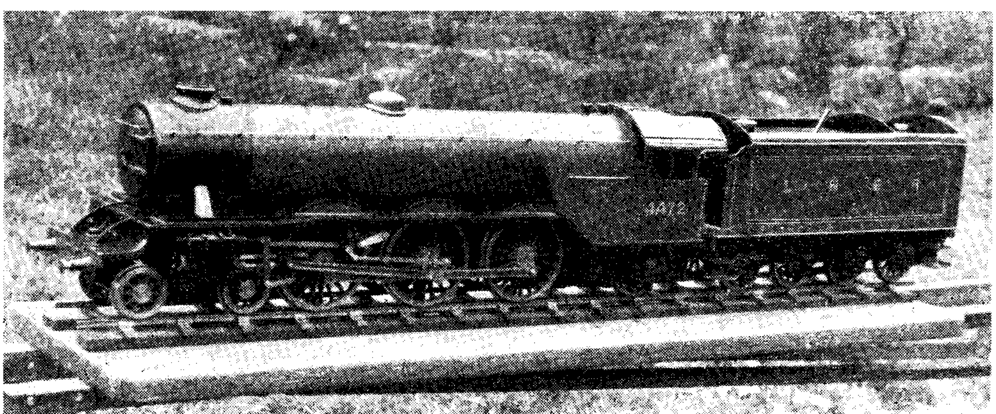
Some Locomotive Models

by L. W. Sampson

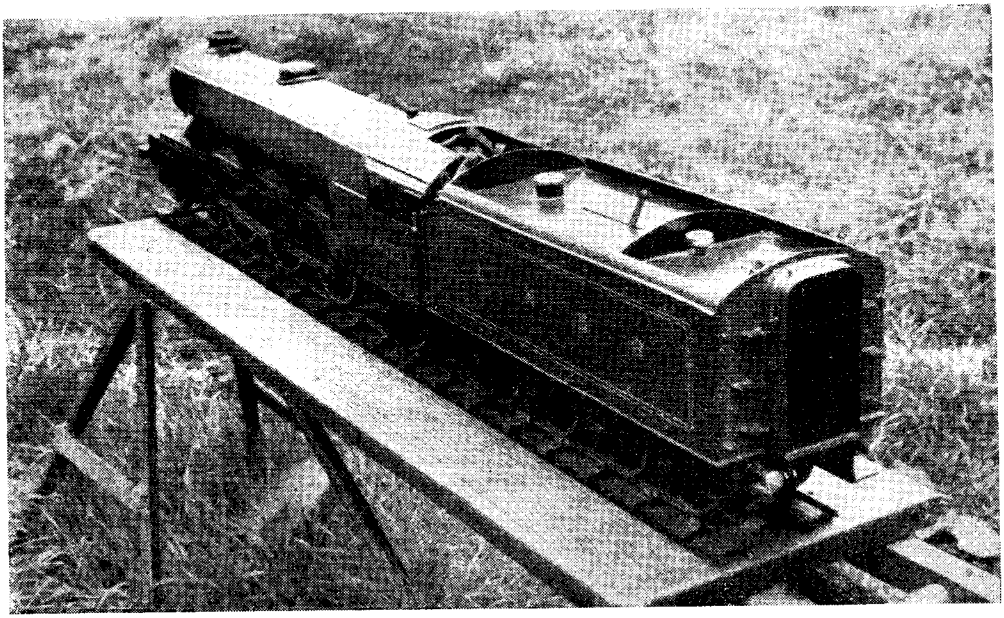
IT all started back in November, 1937, with the old locomotive bug biting me. The first, but simple piece of small locomotive engineering started with a set of finished parts for a Gauge " O " 2-6-0 steam Mogul. At that time my workshop was in the kitchen, the bench was the table, with a small vice, a few files, etc., and little or no knowledge of fitting. After surmounting the difficulties a rank beginner meets I finally finished the job which worked quite well for its type.

After a while I ran into a long lost friend, and was delighted to know that he was in process of building " L.B.S.C.'s " *Miss Ten to Eight*. After seeing his workshop and the chassis, I became impregnated with desire to build something like it.

First I ordered THE MODEL ENGINEER weekly and decided to build a tender first, to gain experience. The tender chosen for ¾ in. scale was a L.M.S. type, as used on the *Princess Royal*. After acquiring castings and drawings from H. P. Jackson of York, work began in my friend's workshop on the frames. Wheels and axles were turned under the watchful eye of my friend, and during that time the war scare was on. Finally the war put a stop to it all, and after six years in the Services, I returned with a head full of workshop, lathes and locomotives. After purchasing a wood sectional workshop which measured 8 ft. × 8 ft. × 8 ft. from a retired poultry keeper, and installing a Winfield 4¼-in. centre lathe, screwing tackle, drilling machine, etc., I took up the work I left off six years past.



The model ½ in.-scale " Flying Scotsman "



A view from above, showing details of the model L.N.E.R. corridor tender

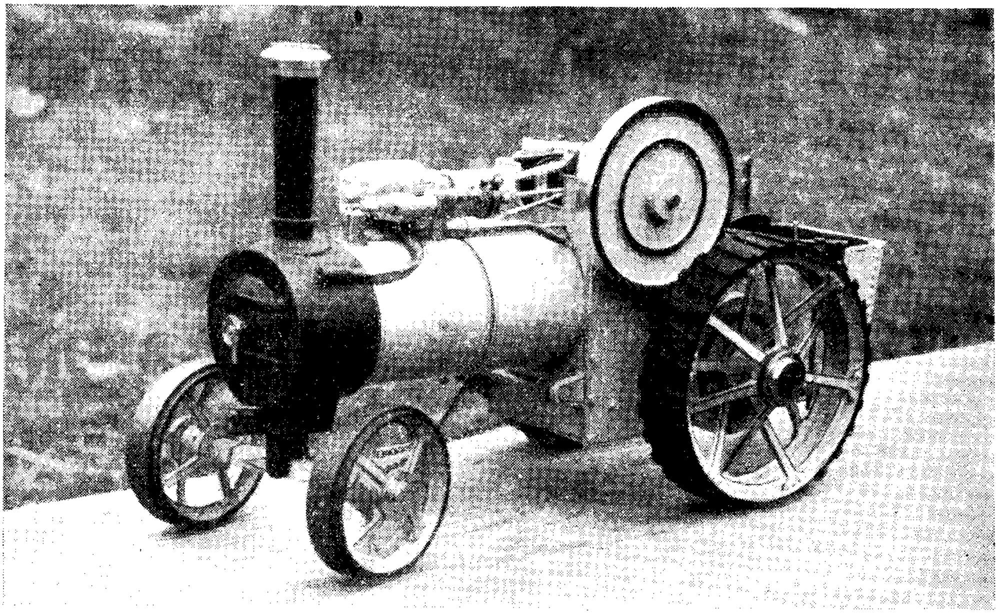
The sides of the tender are of steel and dummy-riveted, and a separate brass tank with an "L.B.S.C.'s" hand-pump is fitted. The tender has dummy springs drilled up the buckle to take coil springs, and working brakes operated from tender column. It was completed and painted in four months.

Castings and drawings were next acquired for the $\frac{3}{4}$ in. scale 4-6-2 Pacific *Princess Royal*, and the real work commenced. On looking over the drawings I wondered at that time if I would ever complete the job. I spent two nights looking through back numbers of THE MODEL ENGINEER for "L.S.B.C.'s" Live Steam notes, dealing with engine frames, wheels, cylinders, etc., as these notes, plus my friend's advice, were my constant tutor. After much hard work with file, hacksaw, etc., the frames, connecting- and coupling-rods, wheels and most of the chassis components were machined, and things began to take shape.

Then came the cylinders. I thought I was really up against it on this job, but, however, after considerable genning-up on machining cylinders in THE MODEL ENGINEER, I made a start very cautiously. I decided to cut out the two inside cylinders for simplicity, and what I thought to be a formidable task turned out to be a most enjoyable, successful job of machining the two cylinders to $1\frac{1}{4}$ in. bore. The steam and exhaust ports were drilled and cut out with a fine chisel, made from silver-steel and hardened. Pistons were made of stainless-steel with a $\frac{3}{16}$-in. groove for a piston ring of graphited yarn, and pistons fitted to the rods per "words and music."

The valve-gear, being Walschaerts, was not a formidable task, but for accurate marking-out. The links, which are of the box-type, were machined on the faceplate and built-up. After considerable fitting the chassis was about due for a compressed air test, so a test stand was next on the list. Two lengths of $1\frac{1}{4}$ in. $\times$ $\frac{1}{4}$ in. steel bar were purchased to form the main structure of the stand, and six ball-races, $2\frac{1}{2}$ in. o.d., fixed by steel studs to the appropriate wheel centres. Scrap pieces of 1 in. $\times$ $\frac{1}{8}$ in. angle, slotted, formed the two supporting ends for front and rear buffer beams so that proper running position of the wheels could be adjusted. The chassis was tested on compressed air and not until considerable adjustments were made did I get the wheels humming round. I really started the boiler work with zest, but eased up considerably on looking over the drawings, and hung fire for a while. Anyhow, eventually, the main boiler barrel was purchased, being $4\frac{1}{2}$ in. o.d. seamless copper tube and 13 gauge thick, which was cleaned and squared up. Formers were made out of hard wood (ash), for the Belpair boiler, each respectively, for the throat plate, backhead combustion-chamber, throat-plate and inside fire box backhead. The plates, which are of 13-gauge copper, excepting the backhead, which is 10-gauge, were flanged over on the formers after about 12 annealings each.

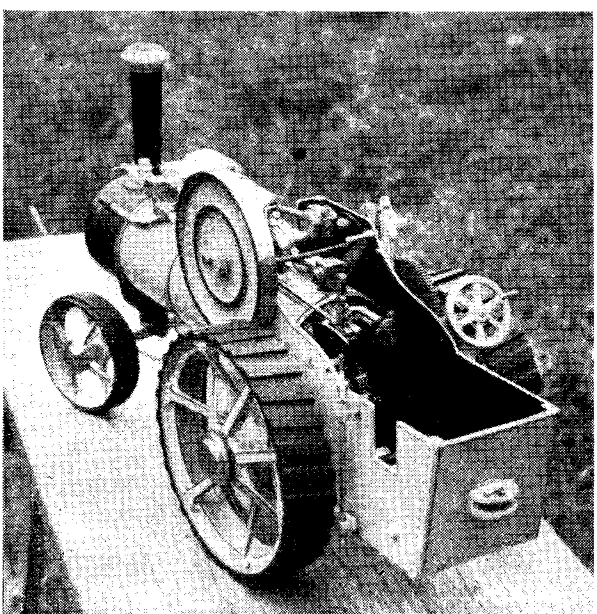
Next came the smoke tubes 16—$12\frac{1}{4}$ in. long, $\frac{7}{16}$ in. o.d. $\times$ 20-gauge, and two flue tubes $\frac{11}{16}$ in. o.d. $\times$ 18-gauge to take the superheater pipes. The smokebox tube-plate and combustion-chamber tube-plates were flanged and combustion-chamber 5 in. long fitted with eight $\frac{1}{2}$ in. o.d. $\times$ 16-gauge vertical water struts. There are two $\frac{1}{4}$ in. solid copper longitudinal stays and one hollow stay for the blower and six $\frac{3}{16}$ in. cross-stays with 3/32 in. thick plate-stays for the fire-box



A three-quarter front view of the model $\frac{3}{4}$-in. scale Burrell type tractor

crown. After all boiler components were cleaned and each unit ready for brazing, two 5 pint and 1-pint blow lamps were made good use of. The job passed on very hot indeed but with success, and after pickling I only found odd spots which needed attention. Then came the final braze-up; all was prepared outside the workshop, but the rains came, and indoors it all had to go, because I was determined to finish the job that night. I have been hot and perspired some in my 34 years of life, but never so much as this night of brazing in the workshop. Believe me, perspiration simply oozed out of my son and myself; regardless, the work went on for about two hours in all. The water test soon found a few of the nutted wrapper stays weeping, which were eventually dried up with a touch of soft tommy, but not so the regulator, which I, without thought, had fitted and brazed in, and the heat had softened the spring holding the valve on its face, as it is a disc in tube regulator. I found out where I had mis-read the drawings, but the headache was that I could not cut out the regulator and re-pad the backhead owing to the closeness of the main boiler stays, so I had to seal the orinigal regulator. off. An idea was taken from one of "L.B.S.C.'s" regulators and I made one out of bronze rod with a stainless-steel disc-valve, with the sausage slot, and it was fitted to the top of the backhead. The steam is drawn out of the top of the boiler through the new regulator, passing down through what was to be one of the dummy exhausting tubes, running each side of the boiler barrel then into a bronze block on the wet head of superheater. Backhead fittings were made per "L.B.S.C.'s" injector steam

(*Continued on page* 595)



A view from above of the scale model tractor

A DIVIDING HEAD

by A. D. STUBBS

WHEN the embryo of the idea commenced to evolve, I realised that I wanted a good rigid base, preferably of cast-iron.

The scrap iron merchant's heap of junk, revealed a nice line in flywheels, but apart from tearing off a strip with my teeth, they did not exactly meet my requirements.

However, we once lived in a country cottage which had roses round the door, but only *promises* of electricity, gas and mains water, and during our sojourn we acquired a couple of common or domestic flat-irons. These have long since been superannuated in favour of one which seems generally to run on about 47 cycles, and consequently they have for some time resided in one corner of the garden shed, periodically enjoying renewed activity as temporary anvils.

One was more or less excavated from other equally useful, but temporarily idle "raw material" and, after an application of my wire brush, gave cast-iron evidence of distinct possibilities. The only snag was that the steel handle ribs had been cast in, but my design

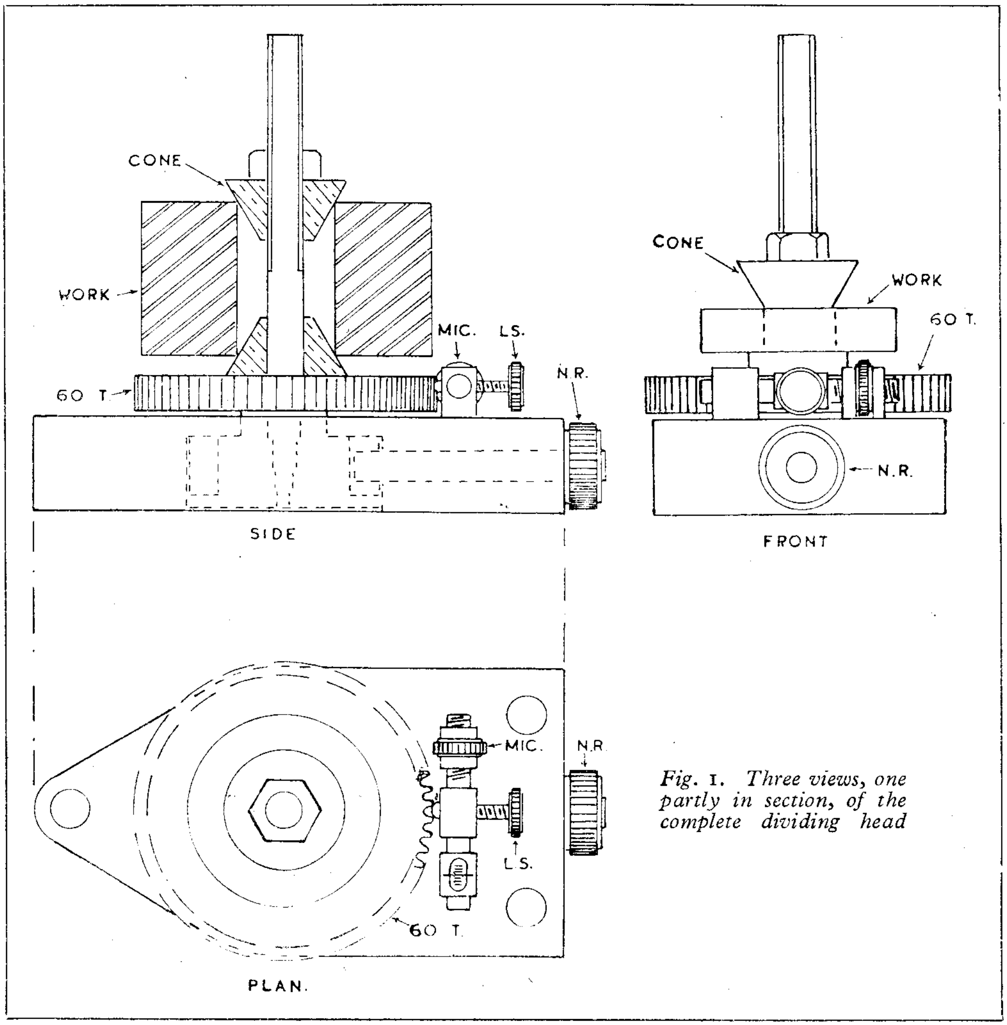


Fig. 1. Three views, one partly in section, of the complete dividing head

managed to miss the doubtful quality of metal at the junctions.

The shape of the base (Fig. 1) plan, almost gives away the source of the iron, but I machined it all over, and had just what I wanted. I have not dimensioned the three holding-down bolt holes in my sketches, as these will require to be spaced to suit individual lathes. Mine are on $4\frac{11}{16}$ in. longitudinal centres, to clear $\frac{3}{8}$-in. bolts, for the Myford cross-slide or milling-slide tee-slots.

Simple Operation

The operation of the dividing head is delightfully simple. My central arbor is screwed into a base standard, on the top of which rides either my 60 or 50-teeth changewheel. The former, of course, gives me multiples of 6 degrees, and the latter produces a useful 72 degrees. Above the changewheel comes a packing-piece (Fig. 1, front), or a cone (Fig. 1, side), to bring the work to the required height, and a second cone follows, with a nut to hold what one might term the arbor assembly rigid, yet capable of rotating as a whole within the cast-iron base.

By slacking off the locating screw (Fig. 1, L.S.), the work can be turned to the desired zero position, preferably coinciding with a position in which the locating-screw tip will home exactly between two teeth of the changewheel when the spindle through which the locating-screw operates is midway in its permitted travel.

Non-rotation of the work is secured by tightening the NR knurled nut. This (Fig. 1, side, and Figs. 5 with 6) pulls a collar into eccentricity with the central arbor base and, acting as an external band brake, prevents the arbor assembly turning.

In order to divide by single degrees, the adjustable spindle is marked off, using a combination set, or a protractor on the central arbor, as shown in Fig. 9, and a corresponding centre mark on the left-hand pillar (Fig. 8) enables you to re-set, or to advance or retard by degrees to three degrees either side of zero. The next tooth of the changewheel, of course, gives you the following six degrees, and so *et seq.*

Forming the "Window"

The "window" in the pillar top is formed by drilling two 9/64 in. holes and filing away the centre to form the shape indicated in my drawings. My micrometer adjusting screw, lettered MIC, enables the setting to be made or altered. Each time the work is moved, the NR knob must, of course, be released and re-tightened after the new setting is made.

As you see, the LS control is long enough to reach a 50-teeth changewheel, or a 55 for that matter, but the latter will not be of much use for dividing purposes. If it is required to subdivide the 7.2 degrees offered by the 50-wheel, the spindle (Fig. 9) could be rotated 180 degrees, and that side of the spindle within the window could be marked. This would be useful, for example, if dividing by 3.6 degrees, but so far my 60-wheel has answered all my demands upon it.

Having acquired the old iron, in its strictly literal sense, Fig. 2 gives you working dimensions. As the side view is sectioned on the centre-line, I show a pillar recessed hole in broken line. For $\frac{1}{4}$ in. depth from the top it is drilled $\frac{3}{8}$ in. to accept the rounded pillar on the portion I have marked *P* (push fit) in Fig. 8. The $\frac{3}{16}$ in. part of the pillar recess accommodates the $\frac{3}{16}$ in. *R* (running fit) portion of the pillar, and the $\frac{1}{2}$ in. diameter at the underside of the recess is there to accept a round nut, slotted for a turnscrew, which holds the pillar rigid. The nuts are not detailed in my drawings. All the internal corners in the recess hole are square, which necessitates the use of the end-mills or slotting drills.

Between machining times on the other components, give the base a few coats of paint, and the job is well on its way to becoming a showpiece, but the under-side should be left clean, for surfacing on the cross-slide.

Fig. 3 dimensions the arbor base. The reduction in size of the central hole enables the $\frac{3}{8}$ in. arbor (Fig. 4) to be replaced by an alternative $\frac{1}{4}$ in. arbor, for work having under $\frac{3}{8}$ in. bore. Having turned up the two arbors, one of my earliest jobs with the dividing head was on a clockwork wheel with a 3/64 in. arbor, which rather cramped my style. To get over this little difficulty, I turned up a plug, $\frac{5}{8}$ in. long, to enter the arbor base and engage the $\frac{3}{8}$ in. screwing, with a turnscrew slot on the screwed end. The $\frac{3}{8}$ in. diameter was centred, drilled and tapped for a 3/64 in. silver-steel arbor, and the job proceeded.

No Slacking Off

The arbor base and arbor are from mild-steel. My collar and spindle (Figs. 5 and 6) are self-explanatory both coming from steel, with the former out of scrap heap, by Me. As a matter of fact, I intended to cross-pin the threaded end of the spindle through the collar, but the thread went up so tight that I left it so, and have had no unintentional slacking off.

The MIC and NR knurled nuts (Fig. 7) came out of brass bar. My clearance of 1/64 in. between the width of the MIC nut and the slot in the pillar gives a sloppy action, and should be considerably reduced. In practice it does not matter, but it does not feel good, and that is one of the jobs I keep forgetting to get down to.

Both pillars (Fig. 8) and the spindle (Fig. 9) are in brass solely to avoid the problem of keeping rust at bay. Where the $\frac{3}{8}$ in. *P* diameter meets the rectangular section, a square corner is needed to bed down on to the cast-iron base, and even if it is bad practice, the job looks very nice.

Fig. 10 is the kind of thing I should like to make a gross of. The end 3/32 in. radius depends upon the pitch of your change-wheels. For high accuracy, the locating-screw should bed on to the change-wheel exactly at the pitch circle diameter, and the 3/32 in. radius should be formed round to part of a sphere, to ensure a rolling motion on the P.C.D.

The last item (Fig. 11) (three off), is the production of holding-down bolts to fit the cross-slide tee-slots. Here again it is "refer to lathe," my dimensions being for my own machine.

One wet week-end, a few summers back, I chewed up a lot of $\frac{3}{4}$-in. steel, making two each of varying lengths of these bolts, for use on either

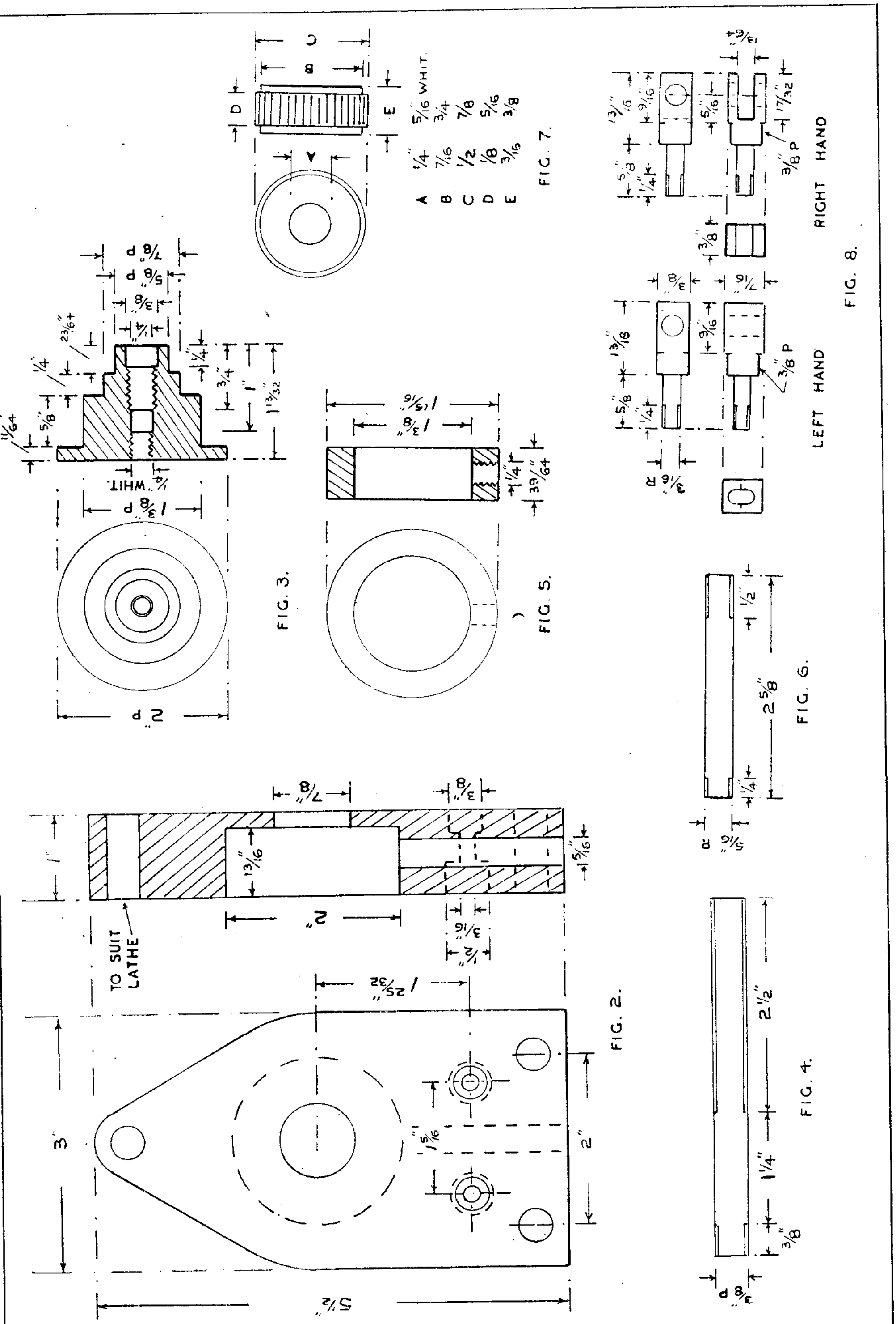


FIG. 2.
TO SUIT LATHE
FIG. 3.
FIG. 4.
FIG. 5.
FIG. 6.
FIG. 7.
A 1/4" B 7/16 C 1/2 D 1/8 E 3/16
A 5/16 WHIT. B 3/4 C 7/8 D 5/16 E 3/8
FIG. 8.
LEFT HAND
RIGHT HAND

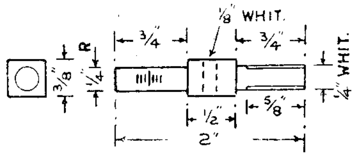


FIG 9

the cross-slide or faceplate, or on the milling slide. Almost the next job wanted four bolts alike. That's the way of life!

Before dismantling the dividing head after

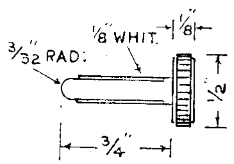


FIG. 10.

finishing a job, remember to tighten NR prior to lifting the head from your cross-slide. Having removed the work and the change-wheel, the arbor-base and arbor are otherwise free to drop. The P fits on the base should prevent such an accident, but the NR screw makes sure of it.

You fellows with 6-in. lathes can have either a longer central arbor, or pack up the complete dividing head, preferably the latter, as a much longer arbor would tend to permit whip under

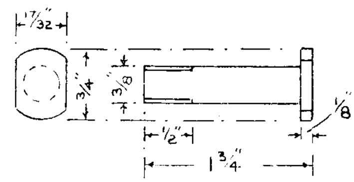


FIG. 11.

pressure of a cutting tool. Anyway, if you have a 6-in. lathe you ought to be satisfied without a dividing head!

Now I'm on the look out for a dial slightly larger than the 60-teeth change-wheel. It would enhance the appearance of the tool, and avoid the necessity of counting up teeth.

Some Locomotive Models

(*Continued from page* 591)

valve, whistle valve, water gauge, $\frac{3}{16}$-in. glass, two feedwater clacks, one wash-out plug and blow-down valve, one feedwater clack under dome for the mechanical pump.

Screw reverse was fitted but found very slow and cumbersome, and was changed for the pole type, working brakes from pole lever in cab. The engine passed its steaming tests with a few adjustments and certainly proved itself, and practice made me a better driver as time went on.

After steam tests the engine was stripped down for painting and a few alterations. Four coats of paint each rubbed down and one finishing coat, then lining in gold which made her look the real thing. The overall length of engine and tender is 4 ft. 10½ in. and working weight approximately 98 lb. The passenger car used for testing the *Princess Royal* was made out of 1 in. × $\frac{1}{8}$ in. steel angle 5 ft. 6 in. long and has two four-wheeled bogies, mounted to turn-tables made out of steam flanges. The axles run on self-aligning ball-races, pressed into aluminium caps fixed to the bogie frames, and found to offer little or no resistance in running.

The track is the straight up and down, 80 ft. long, made out of 1 in. × $\frac{1}{8}$ in. steel angle. It is elevated 2 ft. from the ground and in sections of 16 ft. long. Each section is interchangeable, and is supported by stand made pyramid fashion, three to each section, with fish plates on the top for joining together the sections of track. All was electrically welded with a friend's equipment.

The *Flying Scotsman* which is built to $\frac{1}{2}$ in. scale, was a much simpler job, and this is fitted with Walschaerts valve gear. Cylinders $\frac{11}{16}$-in. × 1 in. stroke with "D" slide valves working over steam ports $\frac{3}{16}$ in. × $\frac{1}{16}$ in. wide and exhausts $\frac{3}{16}$ in. × $\frac{1}{8}$ in. wide. The boiler is of the smithies-type and spirit-fired (working pressure 80 lb.) The regulator fitted is as per notes for *Wee Dot Like Doris*. One feed water clack, blower valve, steam gauge and water gauge.

The Burrell-type tractor, which is the second one to be made, is also spirit-fired with a Smithies-type boiler working at a pressure of 60 lb. per sq. in. Back head fittings, blower valve, water gauge, steam gauge and one feedwater clack. Cylinders $\frac{1}{2}$ in. bore × $\frac{3}{4}$ in. stroke with "D" valve working over steam ports 7/32 in. × $\frac{1}{16}$ in. wide, exhaust 7/32 in. × 3/32 in. wide, steam passages 3/32 in. diameter.

Transmission from crankshaft to road wheels is by brass gears with a reduction of 35 : 1, which makes it quite a powerful little chap. Painting is of the Showman's yellow, with red linings. All models including track and passenger car were made since March 1946, and were in-betweens to starting on a 1 in. scale South African 15F 4-8-0.

To conclude, I would like to thank "L.B.S.C." for his "Live Steam" notes, and friends who have given me information on all this work, without which, I am sure, would have never been accomplished.

PRACTICAL LETTERS

Miniature Traction's Power

DEAR SIR,—I read with interest the paragraph in "Smoke Rings," August 9th issue, regarding the hauling capabilities of model traction engines. My own engine, a $1\frac{1}{2}$-in. scale Fowler compound, was described in THE MODEL ENGINEER about November, 1945, and gained a Silver Medal at the 1947 exhibition. At a club meeting some while ago I had it in steam for members' benefit, and was persuaded to see how much it would pull. My riding truck consists of an angle-iron frame about 2 ft. 6 in. × 1 ft. 6 in. × 15 in. high, running on four flat pulley wheels, the back being 8 in. dia. and the front steering wheels 4 in. dia., all plain bearings. The engine weighs just over 1 cwt. and the hind wheels have rubber tyres (reversed vee-belts pressed on). The floor was wooden planking. By placing a form across the truck and balancing three men on each end, plus two others and myself on the truck seat, we got the load up to 100 stone. The whole set-up was very precarious as you can imagine, but we were able to go round the room half a dozen times before one of the passengers on the form became restless and upset the balance, with disastrous results! A tenth man managed to stand on the back axle of the truck but whilst the engine wheels continued to rotate, the adhesion was insufficient to move the load. The friction of the plain bearings must have been considerable and I think the tractive force must have been between 20 to 30 lb. when hauling this load. I have always regretted that no photographer was on the scene to record the antics of the form passengers both during the preparations and their downfall!

Yours faithfully,
Cambridge. D. J. UNWIN.

An Unusual Horizontal Engine

DEAR SIR,—Further to the unusual horizontal steam engine model recently discussed in your columns, in which the cylinder acted away from the crankshaft, to which it was connected much in the way of a vertical table engine, it will interest steam engine students to know that a full-sized engine of this design exists in Huddersfield. Measures are at present being taken to ensure its preservation and public exhibition in the future as an historical relic of local industry.

This engine has an eight-foot flywheel with only four spokes, and I surmise its age at about a century. Unfortunately, its builder is at present unknown, but until a few years ago it was working as a winding engine, hauling standard gauge railway wagons in a brickyard belonging to the Leeds Fireclay Co. During 1947 Mr. Arthur Brooke (of Elland), and myself found the engine lying derelict, whilst making some researches into local railway history. The owners most kindly gave us permission to make a thorough study of the engine.

In April this year The Leeds Fireclay Co. generously offered the engine for preservation and there is every prospect that a site will be found for it in the grounds of the Tolson Memorial Museum at Huddersfield.

If my surmise of 1850 as the date of the engine's construction is reasonably correct (it is based on the sinking of a small pit shaft on which the engine originally worked), I think that it may well be the second oldest horizontal engine in the country to be preserved; assuming the oldest to be one in the possession of the Clay Cross Company, which was designed by George Stephenson.

Yours faithfully,
Huddersfield. WILLIAM B. STOCKS.

Steam Engine Design

DEAR SIR,—*Re* the vertical steam engine and centrifugal pump described on page 231 of the issue for August 23rd, 1951, judging from the position of the delivery pipe on the pump, the impeller would have to rotate in an anti-clockwise direction to obtain maximum efficiency. The slide bars on the engine are arranged for this to rotate in a clockwise direction; as now arranged the cross-head thrust will come against the strips, instead of on the back face, if the pump is run in the correct direction.

Or am I wrong as regards the direction of rotation of pump impeller?

Yours faithfully,
Bedford. MARSHALL C. FAYERS.

Steam Engine Criticism

DEAR SIR,—The criticism of the engine referred to by Mr. Woodall in a recent issue of THE MODEL ENGINEER is perfectly right, and justified; may it, however, be stated, there were reasons for this departure from correct practice, and provision has been made in designing the model for transposing the columns carrying the guide to their correct position should it ever be decided to run the engine under load.

As the complete model, of which this pump is an auxiliary, spends the whole of its active life at various exhibitions where visitors like to see as much working as possible, the guide was placed in its present position to prevent masking the working parts of the engine when the complete model was viewed from the side on which condenser is situated (see photograph reproduced in THE MODEL ENGINEER for April 17th, 1947).

It must be as gratifying to you, sir, as it is to the writer, to know that an article of this sort excites sufficient interest amongst your readers to enable such departures from the orthodox to be recognised.

It is regretted that annoyance has been caused to any reader; the writer has, however, during his comparatively long life been several times annoyed, but somehow has managed to survive, and still welcomes constructive criticism.

Yours faithfully,
Newquay, Cornwall. "CRANK HEAD."